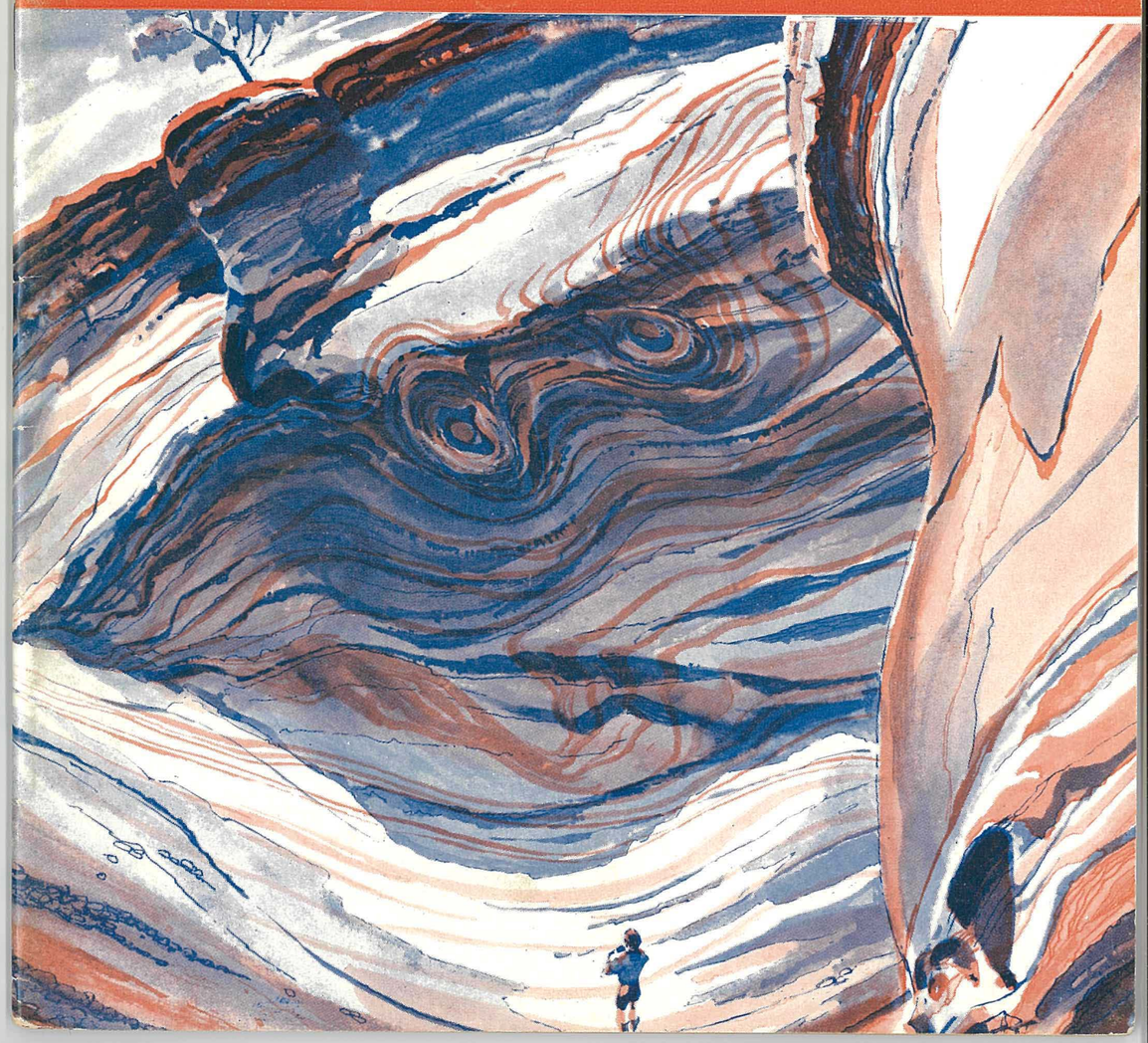
NATURE WALKABOUT

MAY, 1970
VOLUME 6 NUMBER 1

A WESTERN AUSTRALIAN EDUCATION DEPARTMENT PUBLICATION



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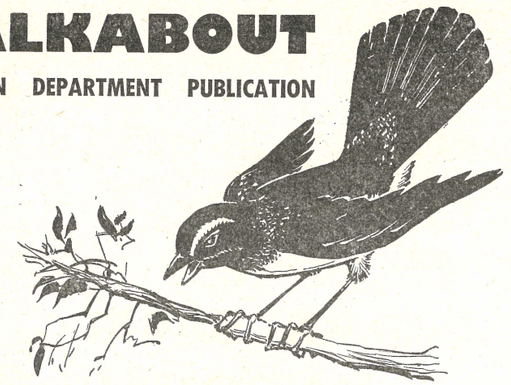
"I will protect all birds, other animals and plants except those that are harmful."



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Dear Girls and Boys—

We live in an age when we seem to depend entirely for our existence on man-made commodities. Our food is so processed and packaged that it is difficult to recognize the original source—plant or animal—from which it came; and we are sheltered from all weathers in buildings which bear little resemblance to the materials of the earth from which they were made. We are dependent for our comfort and protection on the almost innumerable products of modern technology and medicine.

These things so separate us from the real world of wild life that we tend to forget that we are as basically dependent as other creatures are on the well-being of the earth's natural resources. We, too, need clean air, clean water and fertile soil. We all share the one earth and, if plants and animals are unable to survive, our own lives will be in danger. If we interfere too much with the natural life chains or cause too much pollution, we will suffer. Because wild animals are so closely associated with the real world of nature, they are the first to feel the result of any changes we make in the natural environment. They therefore act as an early warning system of undesirable changes in our environment. The more we study wild creatures and their needs, the more we will learn what is happening to our world, what we need to do to keep what we want, and what we must do perhaps even to survive. This magazine is published so that you can learn more about our animals and plants which still survive. I commend it to you.

H. B. SHUGG,
Chief Warden of Fauna.

KALBARRI NATIONAL PARK

The members of the Green River School Nature Club decided that they should try to learn something about parts of the country outside their own district. Hearing that one of their teachers had visited the Murchison Gorge during his holidays, they asked him to attend one of their meetings and tell them about that area. The following is a record of what he said.

Maps show the Murchison River as a watercourse more than 300 miles long. Its headwaters rise in the Robinson Ranges near Peak Hill, some 50 miles north of Meekatharra. On its way to the coast it is joined by two other rivers, the Roderick and the Sandford. If you study a rainfall map of Western Australia, you will notice that the Murchison winds its way across a plateau, much of which receives an annual rainfall of less than eight inches.

Along its inland passage the river has a fairly shallow channel. It flows at irregular intervals, and only when rain has fallen somewhere over its watershed. Occasionally the channel deepens and there occur permanent pools flanked by graceful river gums and dense patches of scrub. These isolated spots were once important camping places for groups of Aborigines. Birds and game seek the water and shade in summer, and in the deep pools fish such as line eyes and spangled perch are able to survive until the next flood enables them to spread and multiply and re-stock the shallower pools which have long since dried up. I think you read of line eyes in the issue of "Nature Walkabout" for October, 1967.

Kalbarri National Park, of some 358,000 acres, includes much of the lower course of the river between the North-West Coastal highway bridge at Galena, an old lead-mining area, and the fishing village and tourist resort of Kalbarri at the river mouth. Within this area the river channel occupies 50 miles of spectacular gorges. In places the gorge is 400 feet deep. It is one of the remarkable natural features of Western Australia.

It is believed that once, as long as ten million years ago, the Murchison River crossed a flat plain in this region. A sudden upward movement of the ground by about 600 feet caused the river to cut down into its old bed. The rock through which the river cut its way is known as Tumblagooda sandstone. Its vivid red formation, and the abruptness with which the gorge

drops from gently rolling sandplain, make the gorge exceptionally striking. Many pools along the bottom never dry out completely.

The gorge is not a single clearly defined channel, but consists of a maze of side canyons, parallel courses and twisting channels. At one point, the main course curves back on itself in a loop eight miles in circumference. Only a steep, narrow sandstone ridge separates the two river channels. From the ridge, the water may be seen hundreds of feet below as a thin silver ribbon, flowing in an opposite direction on either side. Tall river gums which fringe the sandy inside curves of the channel appear as patches of soft grey-green in the depths.

As with all winding streams, opposite sides of the river channel are quite different. In many places steep cliffs rise almost vertically to a height of 400 feet from the outer curve of the stream. On the inner sides, where water flows more slowly, are sandbanks. Here river gums, acacias, rushes, paperbarks and tea-trees form shady thickets. Between the sandbanks and the cliff walls lie deep pools.

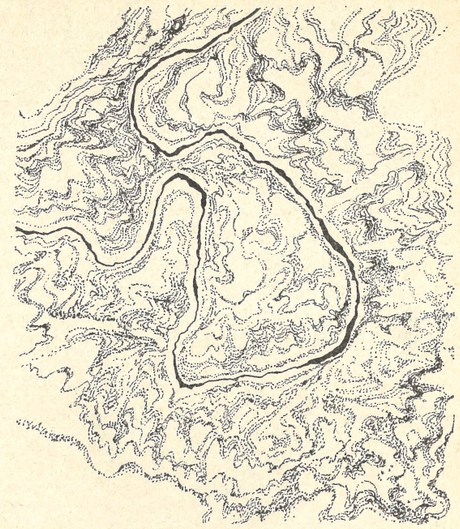
Questions and Exercises

1. List the features which encouraged Aborigines to camp in certain spots along the Murchison River.

2. Give reasons why an area such as the Murchison Gorge should be declared a reserve. Who is likely to benefit from such a reserve?

3. Only humans visit the gorge to admire its beauty; for all other forms of life, water is the central attraction. However, a secondary attraction is often the food which may be obtained there. This food is in its turn dependent on the water.

Draw a diagram with a circle in the centre to represent a pool, with smaller links in a food chain radiating from it. An example of such a chain is pool–dragonfly–dragon lizard–kestrel. Similar chains may be added, ending in some of the water fowl or the pigs.



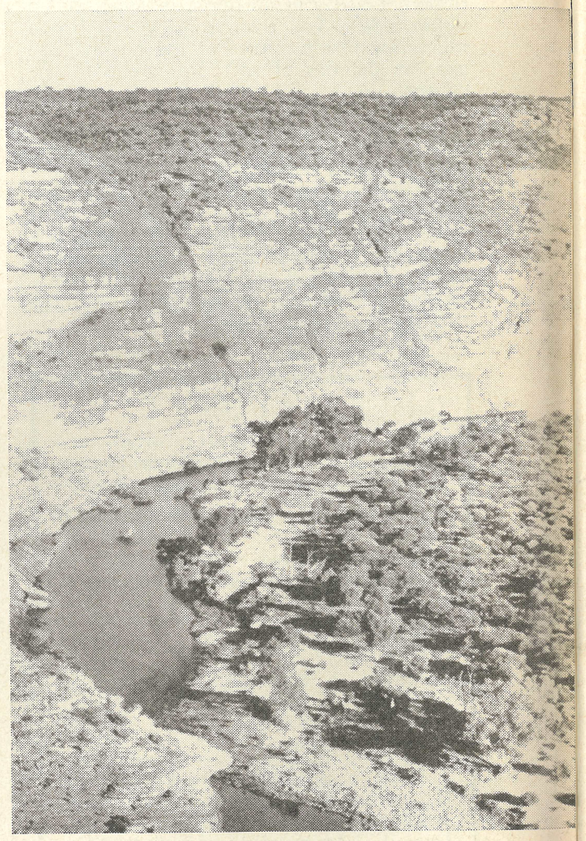
An aerial sketch of "The Loop", a spectacular curve in the Murchison's lower course

To enjoy the most colourful features of the gorge, it is necessary to climb down to the level of the river. There are many places where this can be done safely; even so, we found that it needed hard work and care to avoid an uncomfortable slide over the sharp rock ledges. As we made the descent, we could see inside and beneath the many overhanging shelves of sandstone.

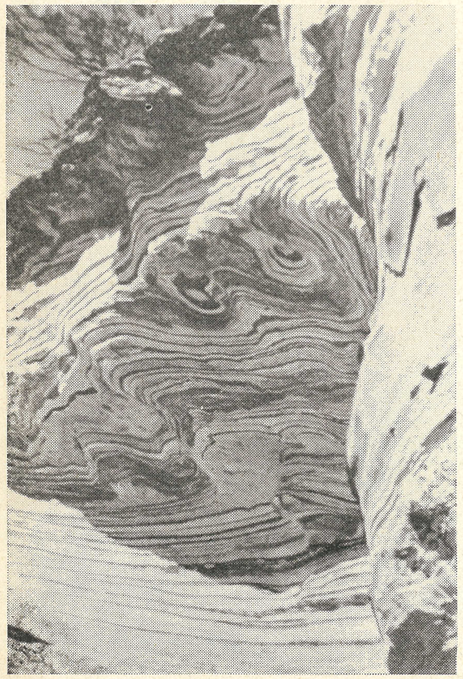
In some places, the cliff walls have remained undisturbed for many years. There the rock is stained and darkened to a uniform colour. Here and there small plants have gained a foot-hold. In other places, where floodwaters have undermined the cliffs, great masses of rock have broken from the wall and collapsed into the bed of the stream. These more recently bared faces of rock reveal the brilliant colour for which the gorge is becoming famous. Bands of brown, red, cream and slate-grey show as fairly even layers of the deposited material from which the Tumblagooda sandstone was formed. Uneven breakages, however, give these coloured bands an endless variety of knotted, twisting colour patterns. Looking up at these, we could see, against the bright blue sky, that many of the points from which we had happily gazed down

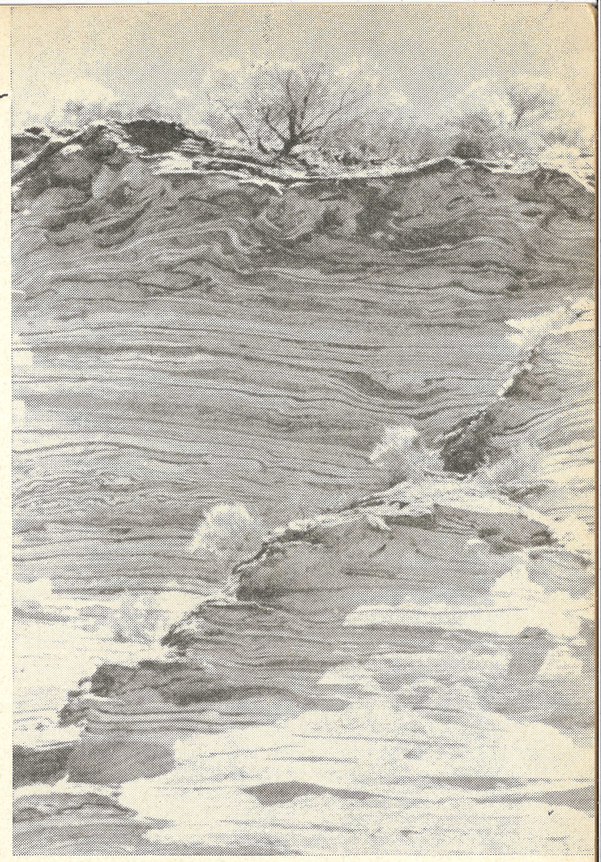
MURCHISON RIVER GORGE

A view from the narrow sandstone ridge separating the two river channels where the Murchison doubles back on its course at "The Loop". Some idea of the height of cliffs and ridge may be obtained from the fact that the trees are 40-foot river gums



This picture illustrates clearly the differences between the opposite banks of the winding river





Looking up at a cliff with an overhanging edge

"The eyes"—a brilliantly coloured pattern on an overhang of limestone

were dangerous-looking overhanging ledges. We decided that in future we would keep away from the extreme edges of the gorge!

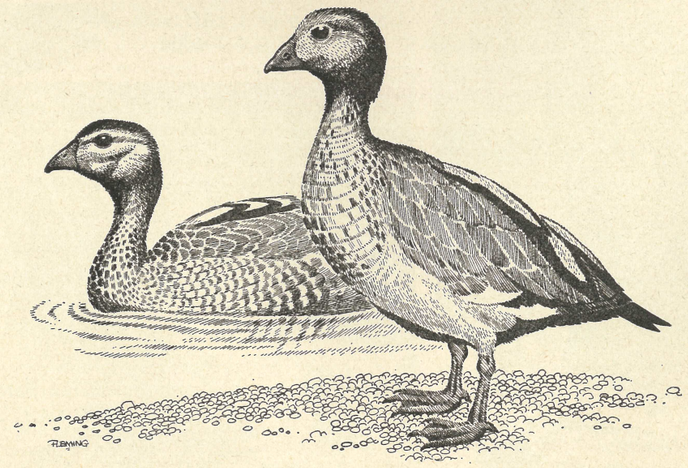
The gorge has quite a distinctive and varied animal life. Many years ago, goats which supplied milk for the pioneers on station properties escaped from time to time. Goats are naturally well adapted to living in steep rocky areas, and in the vast spaces of the Murchison Gorge, with its permanent water, they found a readymade haven. Today, in little groups of a dozen or so, each led by its boss "billy goat", their total strength must number thousands. At sunrise and at dusk, these groups may be seen making their way slowly across the fringing sandplains and down the steep cliffs to the water. The bleating of nannies, the rather higher-pitched, anxious replies of kids, and the occasional deep, Billy-Goat-Gruff call of the herd boss sound plainly at such times.

A second domestic animal which has returned to the wild and found itself a comfortable home in the gorge is the pig.

The pigs are much harder to observe than the goats, but the results of their activities may be seen everywhere. Pigs love to wallow in mud and they burrow into the soil in search of juicy roots and bulbs. Their earth-moving habits have disfigured and scarred many sections of the gorge. Perhaps, now that this area has become a reserve, it would be wise for the goats and pigs to be controlled or destroyed before they destroy much of the natural plant cover, which has had to grow slowly, struggling against hot dry summers and a stony root-hold.

The kestrel, a common bird of the Murchison

Maned geese, usually known as wood duck



Large native mammals such as the grey kangaroo, red kangaroo and euro, or bigada, live in the reserve. They rest in the shade during most of the daylight hours, coming out to feed at dusk. Their move into the gorge to drink is revealed after dark by the rattle of dislodged stones and the soft thud of their feet; fresh tracks in the sand at the water's edge next morning are further proof of their presence.

Emus, which spend most of their time on the surrounding plain, are also regular visitors to the drinking spots, and fresh tracks showed us that Brer Fox was also about after dark.

Water fowl are scattered through the whole course of the gorge. Black swans, black duck, maned geese and grey teal may be seen during the day and heard to call frequently at night. Little pied cormorants, darters, white-faced heron, white-necked heron and night heron perch on favourite snags and fish in the pools and their margins. The most active and conspicuous birds of the day are kestrels. Almost the entire cliff and gorge area is patrolled and scanned by them. Sometimes it is possible to see, at the same time, as many as six birds sweeping or hovering over the gorge, and the birds' high-pitched calls echo among the heights as pairs maintain constant contact with each other. They undoubtedly live on lizards, probably mainly dragons of some kind, which live among the rocks.

The plate-shelled tortoise and the water dragons are also distinctive animals found in the Murchison area.

The cover picture shows an artist's impressions of "the eyes" in the Murchison Gorge.

INFORMATION, PLEASE!

1. What bird is the fastest flier?

The duck hawk holds the speed record for flying. It has been timed at 180 miles an hour.

2. What bird has no wings or tail?

The kiwi. A small, shy bird which feeds at night, the kiwi is found in New Zealand.

3. Which flying bird has the greatest wingspan?

The wandering albatross. It has a wingspread of up to 12 feet.

4. Do birds have large appetites?

Yes. Some small birds eat 50 per cent more than their own weight in 24 hours.

5. Why do most States protect gulls?

They are useful scavengers. They eat refuse thrown from ships at sea and insects which would ruin farmers' crops.

6. What American mammal has a pouch like a kangaroo's?

The opossum. A mother opossum carries as many as 15 babies in her pouch until they are quite grown up.

7. Do whales spout water?

No. They breathe out moist air, which condenses into clouds of vapour when it reaches the cool outside air.

8. How many species of fish are there in the world?

There are at least 20,000 species of fish.

9. How big was the largest shark ever caught?

It was 38 feet long and weighed 26,600 pounds. It was a whale shark, harpooned off the Florida Keys in 1912.

10. What fish "shoots" its victims before eating them?

The archer fish of the Indonesian islands, which stuns small frogs and insects by shooting them with jets of water.

CASUARINAS

The breezes please the sheoaks;
They set the trees a-sway.
The breezes tease the sheoaks
To dance in windy play.
The sheoaks to the breezes
Sing sweetest, saddest songs;
These brown trees love the breezes
To which their song belongs.

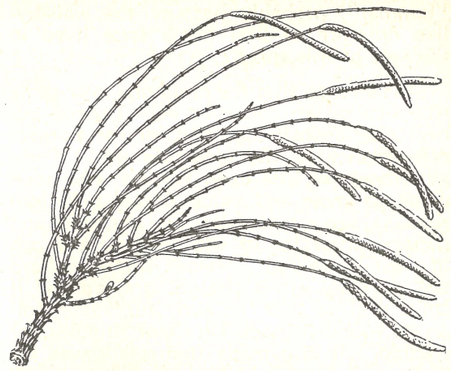
* * *

Sheoaks are one of the best-known and most widespread of all Australian trees. Though not perhaps as well known overseas as the eucalypts, or gum trees, they are a feature of many Australian landscapes, and they have foliage which is quite distinctive.

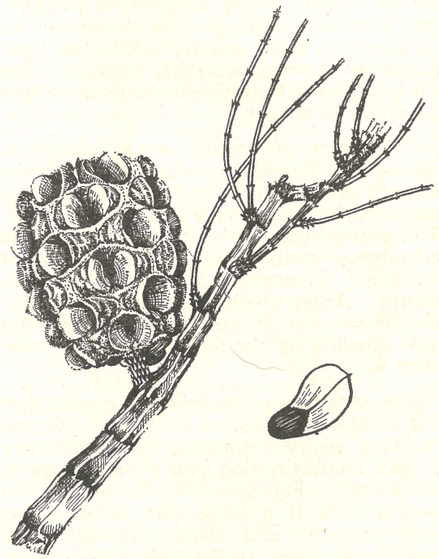
Unlike many common plants and animals, the sheoak bears a scientific name which in some way suggests the graceful dignity of the tree. Sheoaks are known to botanists as **casuarinas**. The word comes from the cassowary, a large, emu-like bird that is native to Queensland and New Guinea. It has feathers which the sheoak's drooping foliage was thought to resemble.

There are at least 22 casuarinas found in Western Australia. Some are large trees of up to 70 feet in height, and others are small shrubs no higher than three feet. Unlike many other trees, the casuarina has both male and female forms. The female tree bears cone fruits which contain tiny winged seeds. The foliage of sheoaks consists of branchlets which are needle-like in appearance. The true leaves are no more than tiny scales, which form a circlet at each joint of the branchlets. (Details of branchlets, scales, flowers and fruits are given in Vol. 1, No. 2 of "Nature Walkabout".)

In some kinds of sheoak, the needles point upward; in others, the branchlets droop gracefully. One kind of sheoak which grows in southern inland parts of Western Australia is quite an unusual tree. So different is its appearance from that of other casuarinas that a casual glance would give the impression that it was a pine. Because of this, it is called **Casuarina pinaster,** or the pine sheoak. Perhaps a better name would have been "needle tree", for the branchlets are so stiff and sharp that collecting the seed-bearing cones is an uncomfortable and difficult task. This tree may be seen growing along the roadside on sandplains east of Lake Grace.



Male flowers of casuarina



Cone fruit of a female casuarina, plus a single winged seed

The many different sheoaks have been given popular names in various parts of Australia. As well as "sheoak", "bullоak" (or "buloke") is widely used for some kinds. Those which live in desert areas are known as "desert oaks"; others are called "swamp oaks". One dwarf species is known as

"tammar", probably because the wallaby-like creature of that name once lived in thickets of this shrub.

It is strange that the casuarina ever came to be called an oak. In their general appearance, sheoaks do not bear the faintest resemblance to the old-world oak. Probably, however, the early settlers, who soon came to know and value timber cut from sheoaks, saw a resemblance in the grain and general character of the wood to the oak of their homeland. Sheoak timber is hard and durable. It is straight grained and it splits well, so that the early Australian colonists found it made excellent shingles for roofing. It also made first-rate staves for casks and kegs, which were put to many uses for storing liquids in the days before steel drums. When dressed and polished, sheoak timber is also a beautiful material for furniture, though its tendency to "shake", or split, and its brittleness have prevented it from becoming popular. The Civic Centre at Cottesloe contains some fine panelling in sheoak.

The common sheoak around Perth is named **C. fraseriana**, after the botanist Fraser, who accompanied Captain Stirling up the Swan River on his first visit, in 1827. This sheoak was widely used in early days as a source of timber, but the supply was not sufficient to support a large milling industry. Trees which would yield easily cut timber are now difficult to find, and wherever possible we should preserve those that remain.

The structure of its foliage suggests that the sheoak developed as a tree well adapted to living in dry conditions, but sheoaks are in fact found growing over a wide range of conditions. For example, **C. obesa**, the swamp oak, is a large tree which grows very quickly and often thrives while actually standing in brackish water. It is a useful tree in helping to reclaim salt lands. The dense mat of fallen needles which cover the ground beneath the tree add humus and fibre to the soil. **C. decaisneana**, the desert oak, lives in an almost treeless area of the sandy inland deserts. Its great, shady, spreading form, growing as high as 60 feet, must have been an exciting spectacle for early explorers, such as Ernest Giles, as they passed through these parts.

In the desert areas north of the Transcontinental Railway line, near Naretha, a very beautiful and interesting parrot called the **little blue bonnet** makes its home. This bird nests in hollows of the desert oak.

Even the karri forests of Western Australia's highest rainfall region, in the extreme South-West, include a distinctive member of the sheoak family. The tree which grows there, **C. decussata**, is a truly lovely specimen. Tall and stately, with soft, almost fern-like foliage, it has a trunk with thick, rough bark which has led to its being called the "cork-bark sheoak". This sheoak, too, has its special residents, the deep crevices of the bark providing shelter for a species of trap-door spider.

Still another kind of sheoak, **C. equisetifolia**, favours the beaches of northern Australia, southern Asia and the northern islands. Its graceful form may be seen within feet of the sea's edge.

The species **C. huegelii**, a large tree often found on granite outcrops, is common in the Great Southern district. In areas which have been devastated by fire, great thickets of this tree often spring up, choking out all other vegetation and forming entire forests of sheoak. This tree, where it grows in protected spots such as the fauna reserve at Tutanning, near Pingelly, may "take over" to such an extent that many animals which favour other kinds of vegetation may be forced to leave. One marsupial, the tammar, which lives on this reserve, makes good use of the sheoak for shelter, but it needs other growth on which to feed.

Sheoak flowers are quite beautiful, though small and so inconspicuous among the foliage that their presence is often overlooked. They are usually red or pink in colour. The foliage of some sheoaks, particularly in some of the smaller forms, takes on an attractive variety of red-bronze tints at certain times of the year.

SCORPIONS

Mr Robinson had just returned from a trip to the north and inland of Western Australia, bringing with him a number of souvenirs. His wife and daughter were very pleased with the polished gemstones he gave them and his young son was delighted with a boomerang. No one, however, liked what Mr Robinson had brought home for himself—several live scorpions.

"How can you bear even to look at them!" exclaimed Mrs Robinson.

"Don't let them loose near me or I'll faint," cried his daughter.

"They're dangerous, aren't they, Dad?" asked his son, looking at the jars which held the scorpions.

"They certainly carry venom in their stings," his father said. "It can kill all kinds of insects and spiders, and even frogs. Humans find a scorpion sting very painful, with swelling and throbbing. I'm glad none of you likes my scorpions; I want you to leave them severely alone. I have permission to study them and keep notes on their behaviour, but I'll keep them on my workshop bench. I advise you to have nothing to do with them."

His family agreed very readily to this, but they were interested in Mr Robinson's notes of his observations on the scorpions while they were under his care. Following are the notes he kept.

February 14th. Now that the jars in which they travelled are no longer shaking and jolting, the scorpions seem to be settling down well. At first they tended to prowl about on the sand in each jar, with their crab-like claws spread in front of them. I think they use these claws as feelers, for they are equipped with sensory hairs. Although the scorpions have a number of eyes on the section which we might call the head, their sight appears to be poor, at least in the daytime; scorpions are really creatures of the night, hunting for food after dark.

The two sand scorpions are busy burrowing. As they came from a dry area, I have provided each of them with plenty of sand and a few stones. In one jar, the sand is quite dry; in the other, it is dampish. I hope to see which kind of conditions the scorpions prefer.

February 15th. The scorpion in the jar with dry sand seems rather discontented. It dug for a while, but the sand was so loose that any attempt to make a burrow was not very successful. Presently it crept under a stone, where it has remained ever since.

The scorpion in the jar with damp sand has made quite a good burrow. It dug busily with its front legs (not its claws), pushing the excavated material out with its hind legs and sweeping it away with its tail.

Scorpions, of course, belong to the same family as spiders, so they are not insects. They have four pairs of legs, but their most noticeable features are their large claws and their slender tails, tipped with a poison-holding "vesicle", or sac, and a sting rather like a sharp rose thorn. I touched the largest scorpion with the tip of a knife blade. Immediately the scorpion grasped the blade with its claws and arched its tail over its back, to strike the blade with its sting. I could hear it grate on the steel. When the animal is at rest, the sting points harmlessly down at the ground.

The **western sand scorpions** are much the largest of my collection; one measures about three and a half inches in length. I

believe this type is one of the largest of the Australian scorpions. They certainly are fearsome-looking creatures. Their scientific name, I have discovered, is **Urodacus novae-hollandiae**.

In another jar—fortunately a deep, wide one—are a number of **little marbled scorpions**. I haven't been able to count them accurately, for they huddle together under the flakes of bark and piece of old bag which I scooped up with the cluster of them when I collected them in the shed of a deserted farm. They evidently like company.

February 18th. Today, I could see that the sand scorpion in the dry sand was wilting—it even refused to show any interest in a juicy fly. So I sprinkled the sand with water, to damp it. Within a few hours, the scorpion began to show signs of life. By early evening, which is the time when the scorpions bestir themselves, it grabbed eagerly at a fly I offered it—a live fly, for the scorpions, I find, will not eat anything that is dead. No carrion for them!

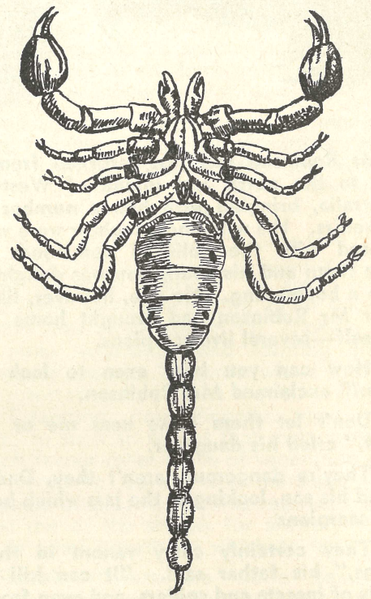
The scorpion whose sand was damp from the beginning has kept on the move. As the sand has dried from the top, the scorpion has dug deeper, extending the burrow into a spiral shape. The man who gave me this specimen told me he had sometimes found these scorpions as deep as six feet in sandy soil. I'm afraid this one is in for a disappointment when it reaches the bottom of the jar!

March 2nd. I have been conducting observations on the eating and hunting habits of my scorpions. I have learnt that, when eating, the scorpion grabs its prey with its large front claws and holds it close to the much smaller claws behind them, which tear and crush the food so that it can be sucked into the tiny mouth opening. A small fly may be torn apart without the sting being used, but anything larger is held while the scorpion curves its tail over and pierces it with its sting. In the case of a blowfly I placed in the jar, the sting was inserted in the head, or very close behind it. With a hard-shelled beetle or cockroach, the scorpion probed about on the hard covering until a joint was found through which the sting could be thrust. Insects seemed to die almost at once after receiving the venom.

The venom does not flow, as with snakes, as soon as the sting has pierced the skin of the victim; it is controlled by the muscles covering the vesicle. The drop of clear, poisonous liquid will sometimes appear while the scorpion is still trying to find a way through the shell of a beetle.

When it has fed on a large victim (for instance, a good-sized spider) and there is nothing left of it but hard parts such as the claws, a scorpion appears gorged and bloated, and may not eat again for many days.

Mentioning spiders reminds me that one of the sand scorpions had quite a lively battle with a large and aggressive spider I



An underside view of a typical scorpion

popped into its jar one day. I was beginning to wonder if I would find myself with a dead scorpion and a triumphant spider, when the scorpion managed to feint with its claws, dart in and whip its sting into the body of the spider. The spider was at once affected by the scorpion's venom and died within a few seconds.

I have read of a two-inch frog being killed by a scorpion's venom, but I don't intend to sacrifice a frog merely to satisfy my curiosity. I did, however, introduce a centipede from the woodheap into the jar of the other sand scorpion. The centipede was quite large, being over an inch longer than the scorpion. A great deal of wriggling, rushing and slithering took place as they circled each other and made swift darts at each other's body. I'm sure the centipede bit the scorpion on one of its legs. The scorpion retreated; but, after a few minutes, it again attacked, and soon stung one of the centipede's legs—there were plenty to choose from! The centipede took no notice at first, then it began to slow down. The scorpion grabbed it and thrust its sting between two of the segments of the centipede's body. The centipede must have been very tough, however. It continued to wriggle, though more and more feebly, for some time; but at last the scorpion was able to begin eating it. It extracted the softer parts of its victim by degrees, taking nearly two days to finish it. This happened only a few days ago, and I don't expect the scorpion to need any more food for a long time.

March 6th. A very exciting event! The larger of the two sand scorpions has turned out to be a female and has given birth to a family of thirty or more—tiny, whitish creatures with black eye-spots. They were born alive, not hatched from eggs, and their first act was to climb onto their mother's back and cling there. She now seems almost lost under their tiny, clinging forms. If, as she moves about, one should fall off, she lifts it carefully with her claws and replaces it. Yet I know that, when they are older and leave her back, they are just as likely to be killed and eaten as any other small creature if they cross her path.

Scorpions, from my observations, do not hunt and stalk their prey as many creatures do. They simply grab anything small and alive which comes within their reach.

April 21st. The young scorpions are still with their mother, but they have grown a good deal, shedding their skins several times. Their colour has become a little darker with each moult, so that they are now nearly as dark a brown as their mother. They have not fed at all since birth; I think that hunger will soon drive them from their mother's back. I must make plans for their future. Thirty-odd scorpions cannot be expected to live together peaceably in a glass jar, even with food provided.

April 25th. I decided to carry all my scorpions into the hills and set them free in some isolated spot where they could scatter and find homes for themselves. Yesterday, I set off with my load of scorpions. It was high time I released them, for the young ones were beginning to tumble off their mother's back and make no effort to return. Their numbers seemed to be growing less, too, and I suspected the mother was responsible.

Nevertheless,I felt quite sad as I removed the lids from the jars and gently poured out sand and scorpions. The day was overcast and I'd chosen a spot between two large boulders, where it was darkish, so the scorpions were not too sluggish, as they are in bright light. Most of them, as soon as they found themselves free, wobbled off on their rather feeble-looking legs, their bodies rubbing along the ground. Soon they had disappeared under stones and into cracks. The little marbled scorpions remained in a group in their usual fashion and headed for a rotting log. The last of the young sand scorpions slid off their mother's back and scattered.

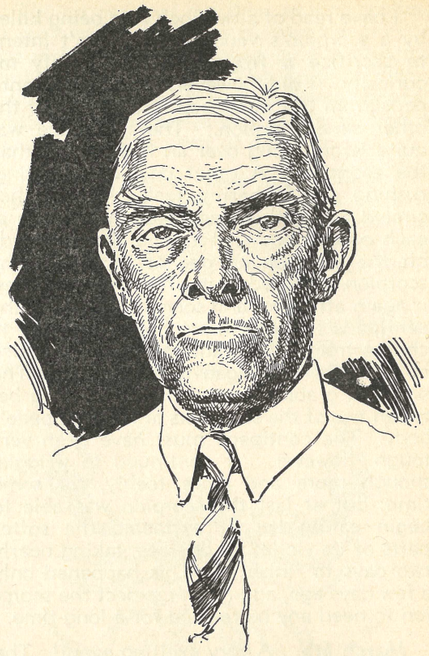
It was unfortunate that the two adult sand scorpions should then have come face to face. I should have guarded against the possibility. As soon as the female realized that the male was in her way, she attacked him. In a moment, they were fighting fiercely. The female quickly brought her sting into play and pierced the male's nearest leg. He did not react at the time, and shortly afterwards stung her; a short while later, he began to withdraw, seeming to lose all his aggression.

I was sorry that they had battled, but it was too good a chance of investigating the results of their stings for me to miss. Scooping each of them into a jar, I bore them home.

This morning, the female was dead in her jar, but the male appeared quite perky. By this evening, however, he also was dead.

This has been rather a tragic ending to my observations on scorpions. Still, there are plenty of scorpions left in the hills!

LUDWIG GLAUERT of the MUSEUM



My own experience of the song of Australian birds goes back many years, and may really be said to have commenced when I was sent to the extreme south-west of our State to make excavations in one of the caves of the Margaret River district in search of the remains of extinct marsupials. After a long and tiring journey by buggy I arrived at the camping-site in the depth of night, too tired and too inexperienced to make a satisfactory camp. Rolled in a rug, I tried to sleep on the bare ground, but whichever way I turned or twisted there were stones or lumps in the wrong places, so that I don't think I slept a wink, tired as I was. When dawn began to break, the silence of the bush came to an end. First one bird, then another, started his song, and in a very short time the wonderful "dawn chorus" was in full song. Most of the birds were quite unfamiliar to me and even today I cannot tell you the names of more than a few of those which took part in that wonderful song of sunrise. I do, however, remember that sooner or later the crow did play his part, and whatever criticism others may have of the notes of this bird, I never hear it without experiencing pleasure, for it reminds me of many happy hours spent in the Western Australian bush.

The writer was Ludwig Glauert, then (1936) Curator of the Western Australian Museum. He was referring to his very early experiences in Western Australia, within a few years of his arriving in the State.

Mr Glauert was born in 1879 in Yorkshire, where his father was a manufacturer. Though the family lived in the industrial city of Sheffield, Ludwig had from boyhood made excursions to moors, woods and beaches. His behaviour on such rambles must have been similar to that he described when writing for West Australian children many years later.

Our naturalist, if he knows his job, will not fail to turn over all stones or logs in his path to see what has sought refuge below. He may find some hibernating snakes and lizards, but he is sure to see many nocturnal creatures which have sought refuge there during the hours of daylight. At dusk, or later, these will awake to set about their business . . . Near the banks of the creek he may make a most interesting discovery, for at this time of the year he may find that the stone or log protects a female frog and her eggs . . .

If the observer has been kneeling, so as to be able to watch more closely, he is sure to have made the acquaintance of some ants. These are there in thousands, and may range in size from the notorious bull ant to tiny forms hardly larger than a pin point. Some seem to regard us with indifference; some give us a friendly nip, while the bull ant, if annoyed or alarmed, can both bite and sting, as many of us know to our cost.

Ludwig Glauert's first interest was in geology. He studied this to university level, finally becoming a demonstrator in the subject at a university. This work, however, did not seem to offer a satisfactory career, so, in 1908, after a short period with his father, he sailed for Western Australia.

Here he became a field geologist with the Government Geological Survey Department. Through this work he developed a keen interest in the fossils of the State. A few years earlier, a large number of ancient bones had been found in the Mammoth Cave near Margaret River, and Mr Glauert was invited to investigate them for the Caves Board. Among the bones were those of the extinct giant kangaroo, wombat and echidna, as well as those of marsupials that are still found in the Eastern States but no longer in the West—koalas, Tasmanian devils and Tasmanian wolves (thylacines).

While engaged on this work, Mr Glauert was appointed to the West Australian Museum, where he became the keeper of geology and ethnology (the science of races and their relationships with one another)—for, side by side with his work on the marsupials, he had become interested in Australian Aborigines.

With the outbreak of World War I in 1914, Mr Glauert joined the A.I.F. and served overseas. At the end of the war he remained in Europe for a while with the Army Education Service, and was in charge of the lecture service of the A.I.F. in the United Kingdom. After a further period, during which he studied at the British Museum and the Royal College of Surgeons, he returned to Perth and resumed work at the West Australian Museum in 1920. There he was appointed head of the natural history department, and later was formally appointed Curator of the Museum. (The title of this position has since been changed to Director of the Museum.)

Mr Glauert at once set out to do all he could to publicize the museum and the wildlife of the State. Articles for newspapers and magazines, talks to organizations and radio talks all helped to keep the work of the museum before the public. He also arranged for frequent items of zoological news to appear in daily and weekly newspapers, and he wrote articles for "Our Rural Magazine", a paper for pupils of the Correspondence School. Readers were encouraged to send specimens of wildlife (such as animals brought in by the farm cat) to the museum. This was a valuable means of obtaining specimens when field trips were impossible, and it was also a means of learning in which districts many of the small creatures of the bush were to be found. Extracts from some of his replies to readers illustrate this.

July, 1928. *W. Rimmington, of South Baandee, whose sister is a correspondence pupil, wrote to say that he had forwarded to me an animal caught in a rabbit trap. This animal was said to go round the traps, biting the rabbits at the back of the neck and sucking their blood, thereby making them unfit for the market.*

The animal forwarded was a beautiful specimen of the common possum, and whatever some of us have to say against Possie, I am convinced that it is not responsible for the damage done to the trapped rabbits. The possum is mainly, if not entirely, a vegetarian; and I have never heard that one has ever taken to sucking blood. One that I had as a pet for several years lived almost exclusively upon vegetable food. In my opinion the damage complained of was not done by a possum but by another animal which Mr W. Rimmington says lives in his neighbourhood. I believe it to be the chuditch or spotted native cat . . . a vicious little creature which, like the English stoat and weasel, preys upon living creatures—birds and mammals—biting them in the neck and sucking their blood in the manner described.

October, 1928. *Joyce Savage, of Orinoco, Buniche Siding, saw an owl as large as a sparrow hawk. Its breast is white and is covered with tiny black specks; it has a white head with big dark eyes; its wings are fawn flecked with a darker colour. I think the bird Joyce found is a barn owl,* **Tyto alba**, *one of the most useful of our nocturnal birds. All children should protect owls and kindred birds because, besides being harmless, they prey upon mice and other pests. It is a tragedy that many useful birds are killed "for sport". The wild turkey is a deadly enemy of the grasshopper and locust, and yet country people*

*often shoot this bird at sight because it is nice to eat! Later these people complain about the "grasshopper plagues" which they have brought about through killing one of the grasshopper's deadliest foes.**

August, 1934. *Eric Singleton, of Lees Hall Poultry Farm, Busselton, writes: "I am sending you a small marsupial which I think is a honey mouse. Our cat brought it in this morning. It had four live young ones in its pouch." . . . Although the animal is supposed to live on honey—and it does abstract the nectar from flowers—the honey we eat is too strong for it. One I had in captivity for several months was given honey and water, bread soaked in water and covered with sugar, as well as flies and other insects* **(alive)**. *These the little animal would catch with great agility and it evidently enjoyed them . . . The noolbenger (honey mouse) soon becomes tame. The one I had used to like being in my waistcoat pocket, and never tried to escape. I used to lick my fingers, dip the tips into sugar, and then put the honey mouse on my hand. It would ascend each finger in turn to lick off the sugar, and I noticed that it would never pass from finger to finger direct, but always came down to the palm before investigating the next finger.*

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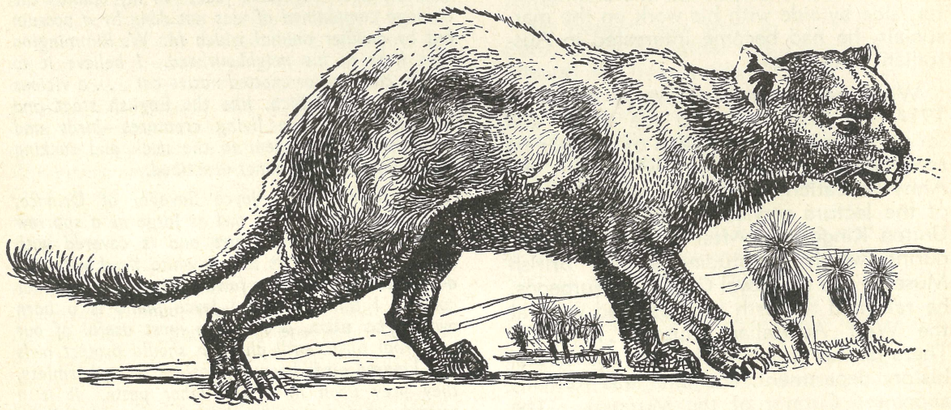
* The wild turkey has been fully protected against killing for many years, but it is still not nearly as common as it once was; it has not yet recovered from the general shooting of earlier days.

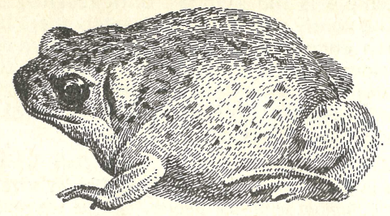
With the help of various correspondents, Mr Glauert and his staff were able to solve the mystery of the **banded stilt,** or "Rottnest snipe". In spite of being quite common as an adult bird, "it has long been one of our natural history puzzles, because people could never find out where it laid its eggs and reared its young . . . "

For some ten years, since the whole of the natural history collections have been under my care, I have taken an interest in the bird, hoping that sooner or later I would learn the truth about its life history. Now and again visitors would describe to me a bird they had seen in thousands on this or that salt lake in the Murchison, the Eastern Goldfields or some other part of the interior; and I would feel sure they were speaking of the Rottnest snipe; and yet, in spite of all my requests, not one of these people could ever send me an egg or even a dead chick.

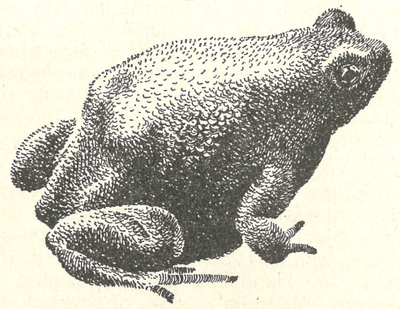
In August, 1929, Mr E. A. Schoch, head teacher of the Kurrawang State School, asked me for the name of a bird known locally as the "snipe". It was 13½ inches long; its head, neck, back and under parts were pure white; the wings were black, barred lightly with white; it had a black bill about two inches long, and the feet at the end of its long legs were webbed. It seemed to me that the bird described was a Rottnest snipe that had not yet put on its adult plumage, and as the note said the birds were breeding and were present in numbers, I asked Mr Schoch to get one of the school children to collect a few eggs and dead birds for me. Alas! It was too late; the birds had gone!



An artist's impression of a "marsupial lion" (**Thylacoleo**), one of the extinct animals whose remains were found in the Mammoth Cave



A frog named for Mr Glauert—
Glauerti mjobergi



Glauerti russelli

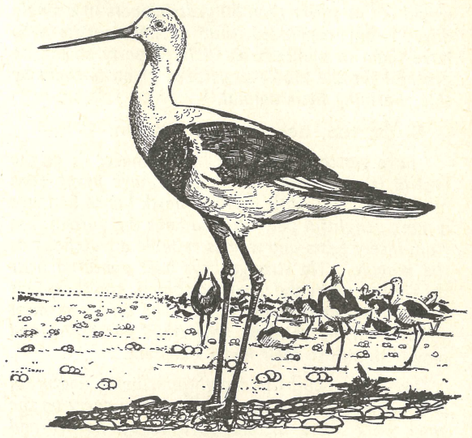
Another link in the chain was forged by Mr T. Smith of Kalgoorlie, who wrote to me last March asking for my comments on the migration of young Rottnest snipe which took place from a lake near Menzies in the spring of 1929. Almost as soon as they were hatched the young birds started to walk to the coast. They died by the hundred thousand, for a strip of country nearly 30 miles wide was literally white with their dead bodies . . .

The matter was becoming most interesting: both Mr Schoch's birds and those seen by Mr Smith were Rottnest snipe, and it was clear that they had been breeding near Menzies and Kurrawang. Soon my hopes were dashed to the ground, for I had no further tidings from Mr Smith, and I presume the birds did not appear in the Menzies district this year.

In the midst of my despondence, I had a most pleasant surprise, for one day in August last two parcels arrived at the Museum from the Lake Grace district. Both contained eggs that I did not know, and in one letter were photographs which proved to me that at last I had before me the eggs of the Rottnest snipe!

Mrs E. B. Cannon wrote: "We found thousands of them (the eggs) on a sandy spit running out into Lake Grace. The birds have long, sharp black beaks, long pink legs and webbed feet. They are black and white, but the chicks are white like eiderdown, with black beak and legs." A few weeks later Mr and Mrs Cannon again visited the lake and then sent to the museum no less than 23 eggs from deserted nests. Nineteen of these we managed to blow successfully, though they were addled; and to my joy, from one of the others we extracted a dead chick about ready for hatching. To make extra sure, I asked Mr Cannon to look out for dead birds, and soon I received two in adult plumage and one very like the bird described by Mr Schoch. There was no further doubt in my mind, and I could announce that at last we had discovered the nests and eggs of the Rottnest snipe.

In notes that appeared in the press I asked readers for information. Mr H. S. Day of King Rocks wrote to say that tens of thousands of the birds had reared countless numbers of chicks on



Banded stilts, sometimes known locally as Rottnest Island snipe

Lake King, ninety miles east of Lake Grace; and Mr S. Repacholi of Kondinin remarked that this was the first time the birds had visited the lakes near Kondinin since 1918; and here we seem to have an explanation of the curious state of affairs. The birds, which feed upon small crustaceans living in salt lakes, are sure of plenty on Rottnest Island during the summer, but when it comes to moving inland and rearing their young they have to go here or there according to the season. It is the rainfall that decides the proportion of salt

in the water, and if there is not the proper amount then the "fairy shrimps" and their kin are unable to thrive. The whereabouts of the birds is governed by the food supply, and this is controlled by the winter rains.

Mr Glauert always wrote and spoke strongly in favour of conservation. While admitting the grass-eating competition of kangaroos in pastoral areas and the harm possums could do in orchards and gardens, he was firm about the usefulness of smaller, insect-eating animals.

It would be wrong, because of the misdeeds of these vegetarians, to condemn the smaller insectivorous specimens. Of the dalgite, the quenda or bandicoot and several of the so-called pouched mice, I can speak from personal experience . . . .

Of a size about that of a domestic mouse are the dunnart and the fat-tailed dunnart, the former living near the coast and the other farther inland. These efficient little insectivorous marsupials have surprising appetites; one I had some years ago would eat no fewer than 50 grasshoppers in a single day. I am convinced that agriculturalists who have them in numbers on their property should be grateful for the kindly assistance given to them by this charming little animal."

Birds, too, deserved protection.

I have watched the little "wind hover", as the kestrel is sometimes called, but I have never seen him misbehave; while a brown hawk I once had was a most delightful pet. It also kept the garden free from insect pests and was as reliable a watchdog as the magpie. No strange boys ever ventured near the fig tree while the hawk was about, and there was no need to set a mouse trap. The bird was most gentle with my children, who could nurse him and play with him to their heart's content.

Owls, frogmouths and nightjars, being nocturnal birds, are often shot at sight . . . They carry on the good work done in the daytime by hawks and numberless insectivorous birds, hunting both on the wing and on the ground. Owls wage war on mice, while the frogmouth and nightjar kill insects on the wing. Insects, including grasshoppers, moths and beetles, have been found in their stomachs.

Reading Mr Glauert's accounts and the letters from which he quoted, it is clear that there was an abundance of wildlife in Western Australia only 30 to 40 years ago and that his warnings on the need to conserve and protect the animal population have been more than justified over the years in which many of them have become much rarer or close to extinction. An example is the numbat, until recently said to be nearly extinct (though lately there have been encouraging reports of its survival in various places). In August, 1934, in "Our Rural Magazine", he quoted from letters from several sources, and added some of his own experiences of the numbat.

Eva Wills of "The Nook", South Dale, wrote to me in June: "I am forwarding by Monday's train a little numbat with four babies. I hope she reaches you safely . . . We found the numbat on Saturday last, and we have been feeding it on termites, bread and milk and finely chopped meat."

I am very pleased to say that the animal did reach me safely and in good health. We could not find any food for it the day it arrived, but the next morning it was given lots of termites and since then it has had plenty to eat, with the result that it is still fit and lively in the large roomy cage that now forms its home. What is far more interesting is that the babies are growing fast and becoming quite hairy . . .

Reptiles were another of Mr Glauert's great interests. Snakes and lizards were the subjects of many of his talks and articles, and in 1950 he brought out a little book, "A Handbook of the Snakes of Western Australia". He discovered and wrote articles on a number of "new" snakes, lizards and freshwater tortoises. He also became an authority on the scorpions of this State, and made the first discovery of a little freshwater crustacean in swamps near Perth.

His work was valuable in other ways. He welcomed overseas and interstate scientists and naturalists at the Museum, helping to establish good relations with zoologists over the world. His help and advice were always available for students of secondary school, technical college and university, and he had considerable influence on some young men and women who went on to do important work in some branch of natural science. It was also during his term of office that the Museum classes were begun at the Perth Museum—the first to be conducted in Australia. This alone should have earned him the gratitude of many thousands of school pupils over the years.

As a result of his researches and free sharing of his discoveries and knowledge with other scientists, many new animals were namd after Mr Glauert—for instance, a native rat discovered in 1926 was named

Rattus glauerti. He was honoured with awards by several societies and he received the M.B.E. in recognition of his work for natural history in this State. When he retired, in 1957, he was given the title of Director Emeritus and was invited to use a room and facilities at the Museum for continued study. There he worked for a few hours each morning, first on local reptiles and later on scorpions, until shortly before his death. He died in January, 1963, in his 84th year.

THE WEB OF LIFE

While Mr L. Glauert was Director of the Perth Museum, he wrote many articles for the Correspondence School publication, "Our Rural Magazine". Here is part of one he wrote in 1934.

One of the most entrancing studies available for the naturalist is that afforded by wild nature around him. The area selected need not be large: a paddock, a garden or even a single tree will provide material for the investigation.

Who has not noticed the astounding activity of life on a wattle tree on a bright sunny day, when the flowers are out? Ants are running up and down the trunk, bees and other insects are busy among the flowers, while hosts can be seen hiding in holes and crevices on the trunk and branches. Under a piece of loose bark we are sure to find silverfish, cockroaches, beetles and other nocturnal insects hiding from the light of day, associated with centipedes, small scorpions and perhaps even a lizard or two.

The activities of ants are seen, upon investigation, not to be merely an aimless running to and fro, for while one terminus is the nest, the other is perhaps a mass of gum exuding from the tree, the flowers or some "ants' cows", including sap-sucking bugs, for aphids are not the only insects that ants keep for their own enjoyment.

We see from this that there is a definite link between the wattle tree and the ant, either direct, or through the "ants' cows". We might go even further and add birds, ant-lions and other creatures that prey upon the ants, and even the butcher-birds or hawks or eagles that prey upon the ant-eating birds and lizards.

The wattle tree is, moreover, also linked with the flies, the birds and the bees that visit the flowers, together with the butterflies and moths that lay their eggs upon it, so that the caterpillars may feed upon the leaves. The wattle tree is also linked with the moths and beetles whose larvae bore into the living timber. The wattle tree is also linked with the possums and wallabies and perhaps even kangaroos which feed upon the tender leaves and shoots.

Spiders make their webs in the branches to catch the flying insect visitors; hunting spiders and the praying mantis crawl about the twigs and branches, seeking what they may devour; while numerous other creatures, both large and small, may be present as internal or external parasites of the insect community living on the tree, or of lizards, birds or mammals that prey upon its members. There is also the mistletoe whose seeds have been brought to the wattle by the "mistletoe-bird" which chanced to fly to the tree and wipe its bill upon a branch, after having fed upon mistletoe berries. This mistletoe has its enemies; for at least two kinds of butterflies lay their eggs upon it, so that the caterpillars may have the food that suits them best. The wattle tree and the mistletoe are visited by hunting wasps that search for caterpillars as food for their own grubs, and by small parasitic wasps that lay their eggs on the caterpillar in order that the grubs may feed on the living body of their host.

The more we study the problem, the more bewildering it becomes; the circle grows larger and larger; it embraces smaller circles and establishes contact with others of the same kind, forming a veritable web of life.

CONSERVATION DAY

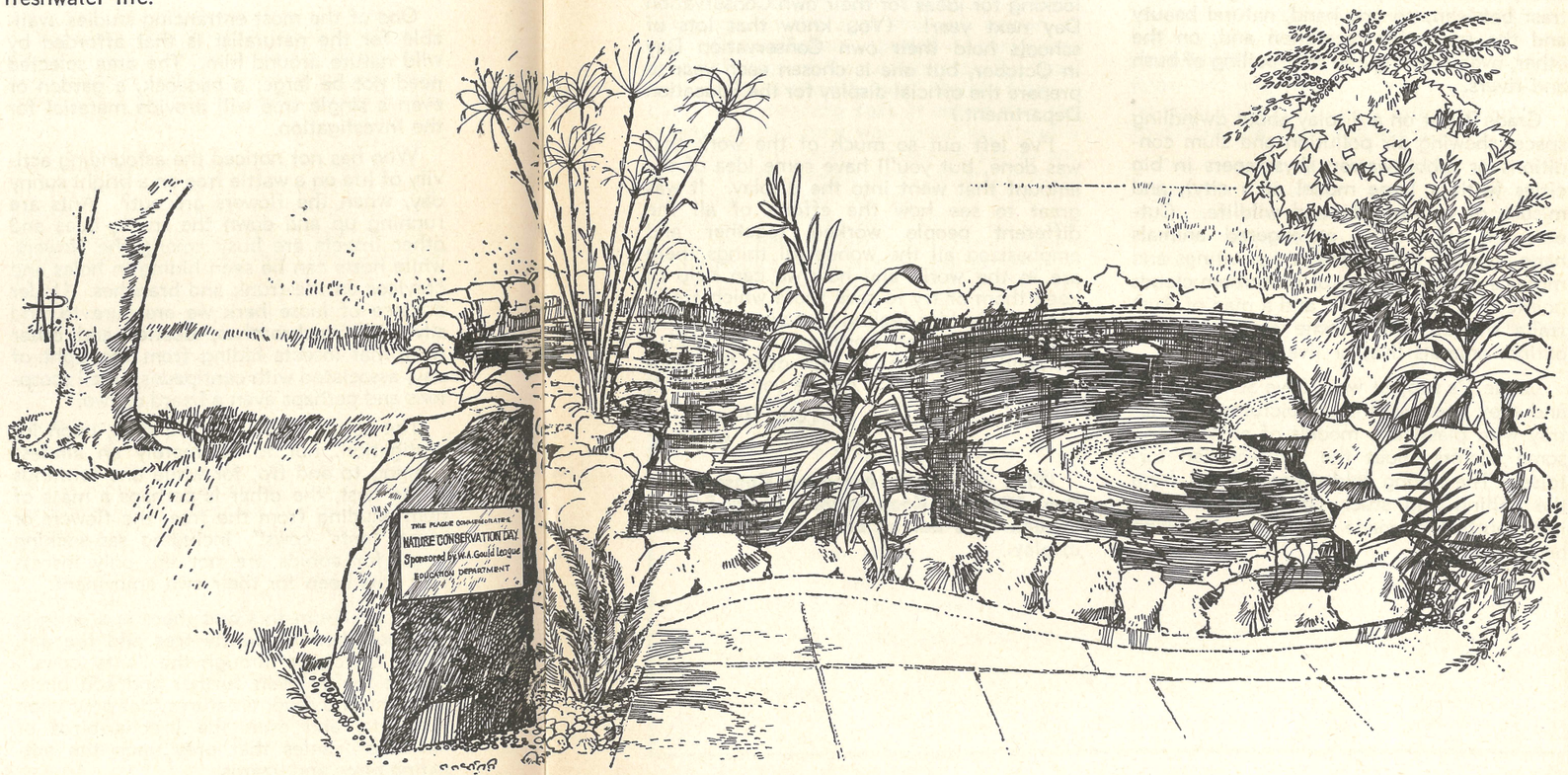
Dear Grant,

I'm very sorry that you missed Conservation Day at school. You would have enjoyed it. It was a great success, we think. Mr Burton said he was proud of us, and we were a bit proud of ourselves!

You had to go to the Eastern States just about the time we heard that our school was to hold the official display for Conservation Day this year, so you missed all the planning and work for it. It was decided that, besides making sure that our gardens and patch of bush looked their very best, we should have a school project and each room should have a display on a different topic. Our room chose "The Life of the Sea" as our subject—but I'll tell you about the room subjects later. First I must tell you about the school project.

This was to make a couple of connected ponds in the garden, near the main gate. (It's the first thing you'll see when you return to school.) It was one of the first jobs tackled, because there was a good deal of work in it. We had outside help with laying the pipes and installing the pump, but the boys did the digging, carted stones, mixed cement and generally built the ponds, under Mr Gordon's instructions. These ponds looked fine when they were finished, and they will look better still in a year or two, when the ferns and other plants have grown around the ornamental rocks and the water-lilies have spread further over the water. One pond is a little higher than the other, and water slides from it over smooth rocks to enter the lower pond. In the middle of this second pond there is a very small fountain, which splashes and tinkles.

Mr Gordon's class display followed up the idea of freshwater life, which you know is one of his great interests. The aquariums in his room were well stocked with jilgies or with pygmy perch and other fish. The art display in this room was also based on freshwater life.



While we were working on the ponds, preparations went on for the displays in the classrooms. Some pupils worked on project books or folders in class or at home, some made models of birds, animals, butterflies, trees and so on in their art or craft lessons, some drew pictures or made paintings on the subject for their room, others gathered specimens during science lessons or brought them from home—you know the ways we can build up material for a display.

In our room, we covered one wall with posters, drawings and written accounts of different forms of sea life. "Nature Walkabout" was a handy reference here. The cupboards were made into display tables for preserved specimens in bottles, stuffed or dried specimens and collections of shells. One that excited all the girls was an oyster shell containing a pearl. There was a fine collection of dried sea-horses and a small stuffed shark, also a sucker fish in a bottle, showing the ridged pad by which it attaches itself to a shark. We borrowed cray-pots of different kinds and several fishing-nets. A couple of these nets were draped over walls and windows and were dotted with cut-outs of prawns and all kinds of fish. To make everything seem more real, we pasted green cellophane over the window panes, which gave a dim greenish effect, and had a sprinkler playing on the ouside of the windows. With the water running down outside, you could almost believe that you were beneath the waves.

I can't describe all the rooms in detail. You can guess whose class worked on an Aboriginal art display, and you won't be surprised to hear that we had a bird room, with lots of projects and pictures, live birds

in cages, and a collection of old nests of various kinds. There was also a very good model of a black swan, whose feathers were made of pieces of blackboy, stuck on and painted black, giving a realistic rough effect.

One room featured protection of trees, with displays of nuts, bark and flowers from local trees, and of the kinds of animals and insects which live in the trees. Another room took as a subject the uses of trees to man and showed a model mill-town as part of their display. Some of the little children had wild-life protection as their subject and they had a mural showing all kinds of animals holding a protest march, carrying placards supporting conservation and protesting against wasteful killing. Another junior grade concentrated on the need for open spaces, with models of trees and animals, and posters showing the contrast between, on one hand, natural beauty and the space for recreation and, on the other, overcrowding and the spoiling of bush and rivers.

Grade 7 put on a display about dwindling space, showing air pollution and slum conditions or rabbit-warren skyscrapers in big cities (with a large model of a city), and misuse of countryside and wildlife. Cut-outs of extinct or endangered animals hanging from the ceiling and paintings and mosaics of eroded land or mushroom clouds pointed out the dangers, and a map of Australia showed where some of our rare or extinct animals live, or lived.

Grade 1's subject was "Save Some Bush", and they used wildflower pictures, a sand-tray with plasticene models of animals and some posters about the short-necked tortoise. They hung folded-paper birds from the ceiling and stuck on the blackboard large butterflies made from crayon-drawing books.

Of course there had to be a display on water conservation, with a model of a farm, complete with dams, tanks and windmills, and in the same room there was a model of an irrigation system.

The actual Conservation Day, with lots of important visitors, friends and parents, was the crown of it all. We had an official opening in the morning, with a few speeches and thank-you's and an explanation of what conservation means. A plaque about the ponds was also unveiled. After that, there was folk-dancing on the school oval. The rooms were open for inspection all day and evening, and we people from the senior grades acted as hosts and hostesses, taking visitors around and explaining things to them. That was interesting work, but it certainly kept us busy. Lots of pupils from other schools came with their teachers to have a look. Perhaps some of them were looking for ideas for their own Conservation Day next year! (You know that lots of schools hold their own Conservation Day in October, but one is chosen each year to prepare the official display for the Education Department.)

I've left out so much of the work that was done, but you'll have some idea of the amount that went into the display. It was great to see how the efforts of all the different people worked together and emphasized all the wonderful things there are in the world and how we can help to keep them or try to save those which are in danger. Besides feeling that we were working for something worth while, we had a tremendous amount of fun over the Conservation Day. It's a shame you missed it.

Your friend,
Stephen.

(This account is based on Conservation Day, 1969, at Koonawarra Primary School, though it is not an exact account of that display.)

THE STORY OF COAL

From steaming tropical jungles of giant ferns and mosses to the grate of a quiet family living-room; from darkness and silence beneath layer after layer of sediment, mud and soil to the roar and bustle of a factory—this is the story of coal. Millions upon millions of years, however, lie between the opening and closing chapters.

The story begins some 200 to 300 million years ago, in the ages that are known as the **Carboniferous period** — sometimes called the age of the coal forests, for "carbon" and "carboniferous" come from a Latin word meaning **coal.** It seems that the climate at this time was becoming steadily warmer and moister. Fossils of plants and animals found nowadays in coal, and in rocks occurring in coal seams, show that the vegetation of those days was tropical and that coral-making polyps and other animals of the tropics lived in what are now regions of ice and snow. Even in Antarctica, coal has been found, proving that large forests once flourished there.

Whenever land becomes swampy and the climate humid enough to encourage thick vegetation, it is natural for the remains of dead plants and trees to build up in the moist ground. These remains may not decompose in the way they would under drier conditions, for the great amount of moisture seals off the supply of oxygen needed for the breakdown of the vegetation. (You may know that a garden compost-heap needs to be open to oxygen if the vegetation in it is to decompose and form humus.)

This process of the build-up of fallen vegetation, in which layer upon layer of wood and leaf-mould, partly or very little decayed, piled up and sank, continued in the Carboniferous jungles for periods of time too great for us to imagine.

Activities

1. Examine all the garden fertilizers you can find at home or in shops and see if any of them are by-products of coal distillation, or if they contain such by-products.
2. Draw up a production chain starting with a jungle of the Carboniferous period and ending with your favourite record.
3. From your reading and from the information within the article, make a list of the products of coal which may be used:
   in your home
   at the chemist
   by any local industry
4. List ways in which oil is replacing coal in Western Australia and many other countries.

Further reading: "Nature Walkabout", Vol. 4, No. 1. "Iron".

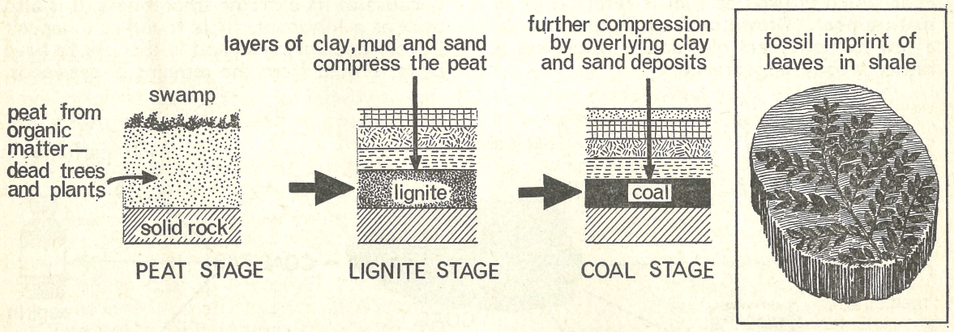
An artist impression of a forest of the Carboniferous period

There were two possible results of this build-up. The swampy land may, in time, have grown much drier, leaving the layer of compressed vegetation as a damp, fibrous mass, of brownish or blackish colour, called **peat.** A certain amount of soil may have been mixed with the vegetable matter. In countries such as Ireland, where peat-bogs are still found, peat is dug out in slabs, dried and used for fuel—chiefly in household fires. It is a slow-burning fuel, giving off a very blue smoke and a distinctive, rather pleasant odour.

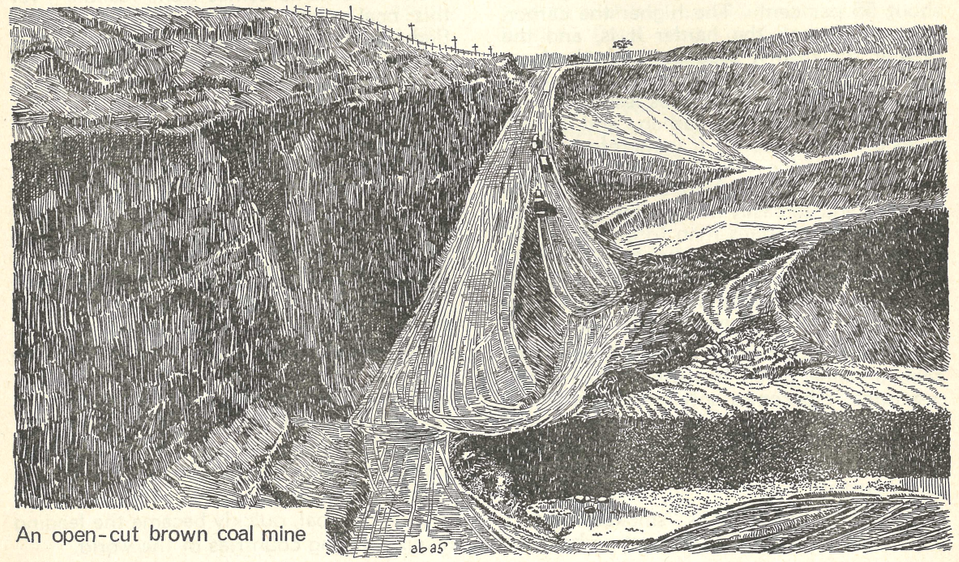
(Some peat-bogs yield more than fuel. The bodies of people, some of very ancient times, have been found, preserved by chemicals in the bog water. Over 160 have been recovered from bogs in Denmark, most of them belonging to the years between 100 B.C. and A.D. 500, but some as old as 5,000 years. Others have been discovered in Ireland, Germany and other countries of north-western Europe. From examination of those bodies, brown and a little shrunken but otherwise lifelike, experts are able to learn about diet and customs of the periods when these people lived and died.)

On the other hand, many of the swamps of the Carboniferous period did not become drier. Instead, possibly as a result of a sinking of the land, they, their forests and their layers of dead vegetation were covered by the sea, which in time deposited sediments of sand and mud on them. As these sediments increased, the growing pressure gradually turned them into rock. In turn, the pressure was exerted on the layers of dead vegetation, squeezing water and other substances from them until almost all that was left was carbon, a substance found in all living matter. The higher the proportion of carbon, the harder the material became, forming into coal. It is thought that a peat layer compressed into coal in this way would have been at least fifteen times thicker than the coal seam which was formed from it. It is also believed that it would take over a thousand years to grow sufficient vegetation to form a layer of coal one foot thick.

The process of coal formation was repeated many times over the ages as the land rose and sank, with forests flourishing and later being flooded in turn. In some regions, numerous seams of coal occur, sandwiched between rock and earth. Below a seam of coal it is usual to find a type of clay, or clayey rock, called **shale**—the earth in which the roots of the coal forests stood.



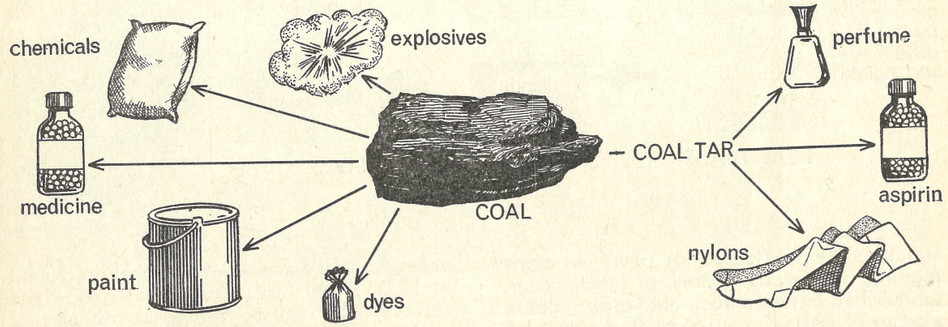
The coalfields of today are only the small remains of the original vast deposits of coal over the earth. The rising and tilting of the land over millions of years brought to the surface many ancient coal-beds, which were gradually worn away through erosion. Other coal seams were buried deep in the earth, so that some layers of coal are found at 12,000 feet (about two miles) below the surface. Of course, mining is not carried out at such depths, but mines are sometimes sunk to over half a mile. The deepest coalmine in the British Isles is in North



An open-cut brown coal mine

Wales; it is 3,750 feet deep. On the other hand, the underground mines at Collie are entered by a sloping tunnel, for they are not deep enough to require a vertical shaft.

Not all the world's deposits of peat and coal date from the Carboniferous period. Peat is still being formed in badly drained ground where suitable vegetation grows. Peat which is used as fuel is referred to as **mature peat. Brown coal,** or **lignite,** is only a few million years old, and it often has a rather woody appearance.



Coal varies according to the amount of carbon it contains. Dry wood is about 50 per cent carbon. The carbon content in peat is about 55 per cent. The higher the carbon content of coal, the harder it is, and the greater the heat it produces with the least smoke. Brown coal, which contains up to 66 per cent carbon, produces less heat than coal containing more carbon, and it also gives off more smoke. It is therefore not as widely used for industry. However, the brown coal deposits at Yallourn, Victoria, are so large and so easily mined that it is better to use these supplies than to go to the expense of importing from elsewhere coal with a higher carbon content. (The Yallourn seam, some 800 feet thick, is one of the thickest brown coal seams in the world.)

Ordinary black coal is called **bituminous coal,** a name given because at high temperatures it becomes soft and looks something like bitumen, or tar. It is black and very hard, but splits easily. This is the coal generally used for coal fires in homes, and for industry.

Anthracite is known as "smokeless coal" and contains about 90 per cent carbon. It is extremely hard and gives a strong heat. Because of its smokeless qualitities, it was particularly useful in the days of steam-power at sea as a fuel for warships which did not wish to advertise their approach to an enemy.

Graphite is almost pure carbon and, mixed with clay, is used as the "lead" of pencils. Because of its extreme smoothness, it is also used as a lubricant. It is found as a deposit in very ancient rocks and is thought to have been formed from the remains of seaweeds.

Another type of coal formed from a slightly different source is called **cannel coal.** (The name comes from "candle", for this coal, when burnt, produces a clear flame said to be like that of a candle.) It was formed from immense masses of drift-wood.

Coal was not generally used as a fuel in the Western world until recent centuries, though it is said that the Romans knew it in Britain 1,900 years ago. When Marco Polo returned from China in the thirteenth century, there were many who scoffed at his tales of how the Chinese burnt "black stones" as fuel. There were other countries in which its use was known, but it is only during the past two hundred years, with the discovery of steam power, that coal has become of vital importance. Countries with plentiful supplies of coal were able to develop very rapidly iron and steel manufacture, textile weaving and pottery making. Great Britain, the U.S.A. and certain countries of Europe, all with valuable supplies of coal, quickly became the leading manufacturing countries of the world.

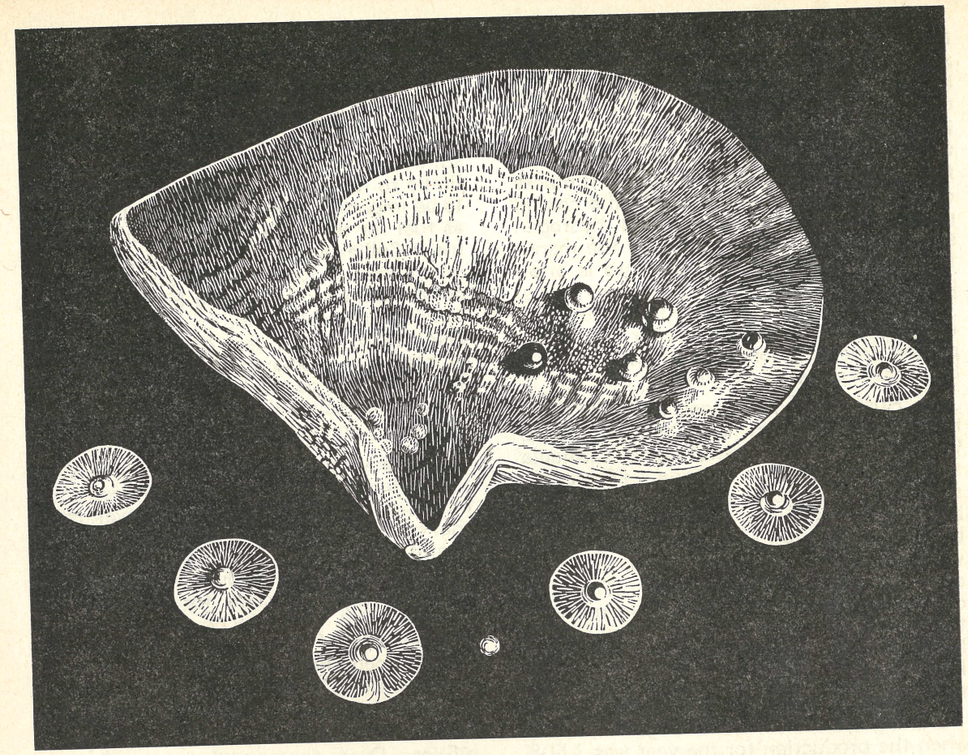
Coke is an important product of coal. It is the residue remaining after all gases, tar and sulphur have been driven from raw coal by heat. This process is called **distillation.** Coke is used in the smelting of iron. In an industrial area, therefore, coal may have two uses—as a fuel to provide electricity for power, and as coke in the blast furnaces of iron works. (By-products of the coking process, such as ammonia and hydrogen sulphide, are saved and used for the manufacture of fertilizers, and coal gas is often piped off as household gas for nearby towns. The gasworks in Perth used to produce gas from coal, but household gas for the metropolitan area now comes from Kwinana as a by-product of petrol refining.)

In Australia, coal ranges from the bituminous deposits of New South Wales, Queensland, South Australia and Tasmania to the brown coal of Victoria. (There are also bituminous coal deposits in Victoria, but they are small in comparison with the brown coal supplies.) In Western Australia, various types of coal have been found all over the south-western corner. The first coal discoveries in this State were made in the 1840's on the Irwin and Murray Rivers. None of these deposits, however, has been thought worth extensive mining except those around Collie.

Mining for coal in Collie began in 1898, when the production for the year was 3,508 tons. The output increased greatly over the years, as more mines were opened. In some, seams up to twelve feet thick were worked, and other seams were as much as eighteen feet thick but contained bands of shale. The average depth of seams over the whole field is now said to be six feet. At first, all the coal was taken from underground mines, but since 1943, **open-cut mining** has been added. In this, the overlying soil and rock is removed and the coal is quarried from the pit thus exposed. Nowadays, about 60 per cent of Collie coal comes from open-cut mining, which is the cheaper method.

Collie coal is **sub-bituminous**—that is, it is somewhere between brown coal and bituminous coal in carbon content. It contains a good deal of moisture, so that when stored it dries out and tends to split and crumble. This, and the fact that it is unsuitable for coking, means that there are limits to its uses, and coal for industry has to be imported. However, it is still employed as fuel for the large power stations at Muja (near Collie) and Bunbury, and also for the much smaller Collie power station. Other power stations of the State Electricity Commission are now fuelled by oil. The S.E.C. takes about 90 per cent of the million tons of coal now produced at Collie each year. The other ten per cent is used by the West Australian Government Railways for their remaining steam trains.

In many parts of the world, as in West Australian industry, oil is largely replacing coal as a fuel. This does not, however, mean that coal will cease to be mined and used. It is still a household fuel in many European countries; and it produces coal gas for domestic use and coke for the iron and steel industry. This is by no means, however, the sum total of its value to man. From coal are obtained chemicals which are employed in the making of thousands of by-products —indeed, there are people who think that to burn coal is a shameful waste of its possibilities. Dyes, drugs, perfumes, explosives, paints, plastics, polishes, antiseptics, insecticides, fertilizers and many other products come from coal. The disinfectant used in your bathroom, the antiseptic you dab on a cut, the nylons your mother wears, the plastic hose which your father uses in the garden, the records you play and the car tyres which carry you over the road may all have originated in coal—or, rather, millions of years ago, in swampy land where giant ferns raised their heads and early amphibians and insects scuttled through the undergrowth of the forests of the Age of Coal.



PEARLS, JEWELS OF THE SEA

Of all the precious stones which have been held in esteem by mankind, the pearl is unique in being the only one produced by a living animal. For this reason, it cannot be considered a gemstone; yet it is certainly one of the most valued of jewels, and it has long been considered the most romantic.

Throughout history, countless stories have been told of pearls and their influence on mankind. Worn by famous women and great rulers, fought over in war and stolen in peace, they have held their value and importance for thousands of years. Men have risked their lives daily in a search for these treasures of the sea, often with tragic results.

For more than 2,000 years, the pearl-fisheries of the Persian Gulf have been in existence, and they are still a major producer of pearls and pearl-shell. Accounts of these fisheries appeared as early as the third and fourth centuries B.C., and it is probable that they yielded many of the famous pearls of ancient times (such as those of Cleopatra).

Pearls are the product of certain molluscs (usually oysters), which have the ability to lay coatings of **nacre** (mother-of-pearl) around a minute object which has accidentally irritated the tissues of the oyster.

The object may be a grain of sand, a worm, or a small fish which has been

swept into the shell. Reacting against this irritation, the oyster coats the object with hundreds of thin layers of nacre. Finally the object may assume the smooth round shape we think of as being usual in pearls. Actually, few pearls are perfectly round, many being pear-shaped, oval or flattened at one end. If one is not quite perfect on the outside an expert, by careful "skinning", may produce a perfect pearl, although reduced in size.

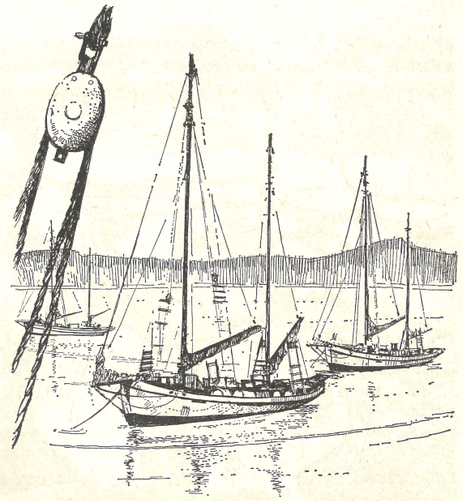
Regularity of shape usually determines the value of a pearl, though size and perfection of the layers are also important. The colour range of pearls is wide—they may vary from white, yellowish-white, bluish-white, pink, red and grey to black.

Sometimes, when a fish or worm is caught within the shell-valves, it may attach itself to the inside of the shell. The mother-of-pearl is then distributed unevenly around

Gathering pearl-shell

the object and a **blister pearl** is formed. These are usually of little value, as they mostly contain mud. On rare occasions, however, a perfect small pearl may be concealed within.

Pearls may be found in many types of molluscs, but only the true **pearl oysters** (which are not closely related to the edible oysters) and the **pearly freshwater mussels** can produce really valuable gem pearls. American and European freshwater mussels produce many fine pearls; Australian freshwater mussels, however, have produced few



Pearling luggers at anchor

of any value. Australia's principal pearl-producing shells are the "golden lip" and the "black lip" varieties. The "Shark's Bay pearl-shell" is a much smaller species, found only in that area.

All molluscs have the ability to lay shelly material around objects which come into contact with them. Knowing this, the Chinese have for centuries made mother-of-pearl coated images of the Buddha by inserting small flat carvings between the shell and the skin of freshwater mussels. Pearl-forming reactions of this type occur in most molluscs, but the majority are not producers of true mother-of-pearl. Instead, they lay down a white shelly material.

Most of the world's great pearl-fishing grounds are situated in or near the tropics. Central America and the Caribbean Sea, the Gulfs of Mexico and California, the Philippines, Borneo, Timor, New Caledonia, Australia, India, Ceylon and the Persian Gulf all have good shell-fishing areas. The Aus-

tralian pearling centres are located around Thursday Island, Darwin, Broome and Onslow. From there, the cutters and luggers sail to the fishing grounds.

The pearling industry, which has provided a fascinating and colourful chapter of Australian history, is now declining. In

1861, an American sailor, Tays, pioneered the industry. He gathered pearl-shells strewn on the beach at Nickol Bay in Western Australia. When these were exhausted, he engaged Aborigines to dive off-shore in deeper waters. In 1868 pearl-fishing commenced in Torres Strait. Most Australian pearling crews have always been of mixed nationality, including white people, Asiatics, Aborigines and Torres Strait islanders.

Some valuable pearls have been found in Australia, one of the most famous being the Southern Cross, found in Western Australia in 1883. It consisted of nine pearls set in the form of a cross, one and a half inches long. Probably Australia's finest pearl was the "Star of the West". Found on the north-west coast in 1917, it was the size of a sparrow's egg, pear shaped, and then valued at £14,000.

The largest-known pearl, however, was the "Pearl of Allah", an irregularly shaped pearl weighing 14 lb 1 oz. It was found in the Philippines in 1934 and was valued, in 1939, at $3,500,000.

There are many different methods used in fishing for pearls. In early times, most divers worked naked, with only a knife for self-protection. Holding their breath, divers from India and Ceylon could submerge for about sixty seconds and descend to nine fathoms (fifty-four feet). Arab divers could submerge for eighty seconds and descend almost eighty feet. Dredging has recently

been tried with success on the Ceylon pearling banks, and it is probable that this will become the only form of fishing used there. Nowadays, divers in Australia are divided between the wearing of the older-style full diving suit with heavy boots, and the helmet-and-corselet method. The latter enables the diver to move about more freely and is used by many of the islanders in Torres Strait. A few prefer the skin-diving method, often with the aid of goggles. Divers normally work at about 15-20 fathoms, but will descend to depths of 40 fathoms if the pearl shell is scarce.

Pearl-diving is a hazardous occupation, even with the protection of a diving suit. Sharks, rays, gropers and sea-snakes are enemies of the diver. Usually, but not always, a shark can be frightened away by the release of air bubbles. Huge-mouthed gropers are fearless, and sometimes a poisonous sea-snake may be coiled around a shell. A diver, bitten by one of these, could be dead by the time he reaches the surface.

"Divers' paralysis" or "bends" is a hazard common to all divers. If a diver ascends too quickly after a deep dive, the nitrogen which is taken into the blood and greatly increased with the water pressure bubbles, and may result in a painful death if the heart fills with air. To prevent this, the diver is staged at different depths during his ascent, giving his lungs time to remove the extra nitrogen. Naval staging methods are used on Australian pearling vessels. During descent and ascent the diver stops for a few minutes at every five fathoms. Great care is taken to see that all diving equipment is in good condition. The air-compressor is tested regularly, and all life-lines, air-tubes, helmets and corselets are thoroughly checked. The diver's life is dependent on their effectiveness, and on the efficiency of the boat's crew above him.

Since the last war the value of the Australian pearling industry has declined considerably. Only three luggers now operate from Darwin and there has been a similar reduction at other pearling centres. Pearl shell, which has been the real basis of the industry's economy, has come in for increasing competition from plastics, especially in the manufacture of buttons. In 1966-7 the total value of pearl-shell and natural pearls exported from Australian was only half a million dollars, a fraction of the pre-war value.

However, a new industry is developing—pearl culture. In 1966-67, nearly two million dollars' worth of cultured pearls were exported, mainly to Japan. Most of the pearl-shell exported by Australia is bought by the United States of America.

As early as the thirteenth century cultured pearls were grown by the Chinese. During the present century, the Japanese businessman, Mikimoto, worked on the process until he had perfected this type of pearl. It became almost impossible to distinguish between a natural pearl and a cultured pearl. Only by the use of special equipment such as X-rays could the distinction be made.

The pearl culturist has developed a skilled technique by which oysters are forced to create pearls. The shell of a live oyster is gently opened and a tiny speck of mother-of-pearl (usually taken from the North American freshwater mussel) is wrapped in a piece of tissue taken from the pearl-oyster. A trained operator then places this "sandwich" of mother-of-pearl and tissue in a suitable place within the body of the pearl-oyster. The oyster is then placed in a cage with many others and lowered to the sea-bed. For several years (usually seven) it remains there. Irritated by the tiny speck, the oyster covers the piece with layers of nacre. Although there are some failures, the majority of the oysters produce a pearl. Many of such pearls are imperfect in one way or another, but a large proportion are good-quality, smoothly rounded pearls.

The centres of pearl culture in Australia are Thursday Island and Kuri Bay in Western Australia. Many cultured pearls from Kuri Bay are sold in Japan and Switzerland and are said to be the finest in the world. Pearl culture is also in operation at King Sound and near Learmonth.

By using the "golden lip" pearl-shell, Australian culturists are able to grow large and beautiful pearls in a much shorter time than can the Japanese, who use the Japanese species of pearl oyster. The huge quantities of cultured pearls which are now available have obviously had some effect on the value of natural pearls. Nevertheless, their price is still about ten times the price of cultured pearls of similar size and quality.

MAKING A HERBARIUM

"What's the name of this wildflower?"

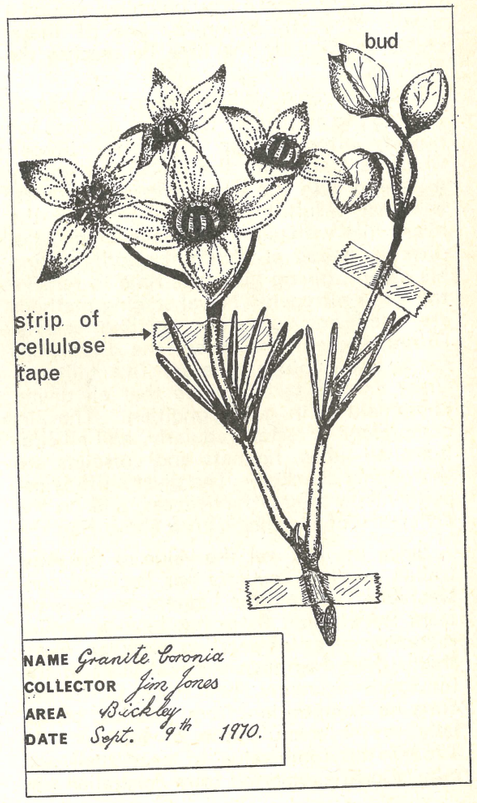
This is a question we often hear when on a bush ramble during the wildflower season. Nearly everyone enjoys looking at wildflowers, and some people like to gather bunches of them. In the past, wildflowers were gathered very often and sometimes very carelessly, causing the destruction of the plant. Added to this, so much clearing of land has taken place that many of our wildflowers are becoming very scarce. A few years ago, it seemed that if people were to go on picking and pulling up every wildflower they fancied, there would soon be none left to grow again or produce seed for the following season.

Laws were made about gathering wildflowers. Nowadays, it is against the law to gather wildflowers on Crown land, unless you have permission from the Forests Department; and you may not take them from other people's land unless you have written permission from the owner. Even so, one can obtain special permission from the Forests Department to collect a few specimens for study purposes.

For those who wish to learn more about our wildflowers, specimens can be kept by pressing and preserving. Once they have been flattened and dried, the specimens can be mounted on stiff paper and stored away in a special container. When accompanied by written notes, they can make a valuable record. We call such a reference collection a **herbarium.**

Collecting the specimens. If the plant is a small one, you may need to take the whole of it (above the ground) in order to obtain both leaves and blossoms, as well as seed-case or fruit. If no seed-case is present, you may have to collect that later in the season. If the plant is large, take a piece which shows leaves, buds, flowers and fruit. In the case of a large shrub or tree, take a sample of the bark as well.

Pressing the specimens. First find some old newspapers, a sheet of hardboard about half the size of a newspaper page and several heavy articles such as large books, bricks or stones. (Some people use blotting-paper instead of newspapers, but newspaper will do perfectly well.) On your return from gathering the flowers and while your specimens are quite fresh, take several half-sheets of newspaper and lay them one on top



of another on the floor in a corner of the room, or on a spare table. This makes a base on which to work. You then go on to make a kind of sandwich of newspaper and plant specimens in alternate layers.

On the paper base, lay one or more of your specimens, arranging them so that the spray of leaves or, particularly, the petals of the flower show to the best advantage. Do not crowd the specimens. When the paper base is comfortably spread with plants, cover them with a sheet of newspaper. Repeat the process until all your specimens have been placed.

Lay the piece of hardboard over the final sheet of newspaper, and put bricks, stones or heavy books on it. These do not have to be **too** heavy, as only a firm pressure is required. If the plants have thin stems and leaves, and the air in the room is dry, the weights can be left in place for ten days or two weeks. Fleshy-leaved plants will need checking every day; and if the newspaper coverings show signs of dampness, they should be replaced with dry sheets. Remember, your aim is to flatten and dry the plants. The faster the drying, the more colour you will retain in the petals of the blossoms and the better will be the condition of the collection. Therefore press thoroughly and, if necessary, change the paper daily.

Mounting the specimens. Now comes the interesting task of taking each dried specimen and mounting it on thin card or stiff paper (such as cartridge paper). It is a good idea to make all your cards the same size, so that you can file them neatly. Arrange the specimens on the card so that all the parts (leaves, flower, fruit and perhaps bark) can be seen clearly; then fasten it in place with strips of adhesive tape.

At the bottom of the card write the name of the plant. If possible, give the common name as well as the technical name, which you may have to discover from a reference book or from someone who has a good knowledge of our wildflowers. In addition, show in one of the lower corners of the card the name of the collector, the place where the plant was found and the date on which it was picked.

The back of the card can be used for notes about the plant and for interesting information added as the years pass. For example, here are notes which might appear on the back of the card on which you mounted your specimens of granite boronia.

Granite boronia (**Boronia cymosa**).
Sept. 2nd, 1970. First flower seen.
Sept. 10th, 1971. First flower seen.
May 6th, 1972. Transplanted to our nature strip near the school.

Storing the cards. Students of your age group should keep the cards of your herbarium stored neatly in a box or drawer which will hold them comfortably without bending or folding. This is known as a loose-leaf system of storage. The cards may be lifted out and examined when needed. This is the most suitable method of storing papers made bulky by the addition of dried plants.

Sprinkle naphthalene flakes among the cards to discourage insect pests, which could soon ruin your collection.

If you build up such a herbarium, you will soon have no trouble answering the question: "What's the name of this wildflower?"

INTRODUCED DOVES

"Miss Benson! Miss Benson!" the children called excitedly, running towards their teacher, who was on duty in the playground. "We've found two pigeons at the end of the oval. They have a nest in the big pine tree!"

Miss Benson, who took a keen interest in nature study, allowed herself to be led across the oval. They all studied the birds from a distance.

"What makes you think they are pigeons?" Miss Benson asked, with a smile.

"Aren't they?" Steve asked, in a puzzled voice. "My uncle keeps racing pigeons and they're rather like these."

"No, they're not pigeons," replied Miss Benson. "They are doves—**Indian turtle-doves.** I haven't seen any previously in our town."

"Why are they called **Indian** doves, Miss Benson?" asked Glenda. "Did they come from India originally?"

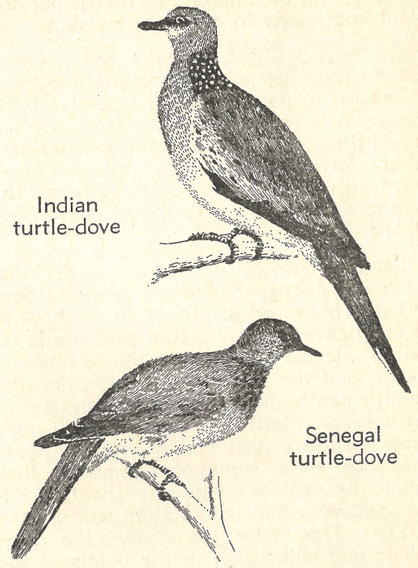
"Yes, Glenda! There were no turtle-doves in Western Australia until 1898. In that year, Lieut.-Col. E. A. Le Souef brought a pair of Indian turtle-doves and a pair of Senegal turtle-doves from the Melbourne Zoological Gardens and placed them in the South Perth Zoological Gardens, where he was Superintendent. He brought them because he liked the gentle sound of their cooing in the early morning."

At that moment, the school bell rang loudly.

"Will you tell us more about the turtle-doves next nature study lesson, please, Miss Benson?" asked Helen.

"Of course!" replied their teacher. "However, don't you think it would be more fun if you found out more for yourselves? You can watch this pair of birds and describe them and their habits; and we have a good library where you can find out more about them. Our next nature lesson is not until Friday, so that you will have plenty of time."

Many of the children were quite busy in their spare time during the next few days. They looked up all the references they could



Indian turtle-dove

Senegal turtle-dove

find on turtle-doves and made good use of the town's public library. One group wrote a description of each dove, and Sheila, who was very good at drawing, made sketches of them. Two of the boys climbed the gardener's ladder to look closely at the nest and the eggs. They were careful not to touch the eggs.

On Friday, the children waited eagerly for the nature study period.

"Who has found out anything about the turtle-doves?" Miss Benson asked, with a smile.

A number of hands shot up.

"I have written a description of the two types of turtle-dove," Susan began. "I will read it to you:

"The Senegal turtle-dove: Its back is brown, with bluish-grey wings, and a lilac shade to the head and throat. The underneath parts of the bird are a pale lilac-brown, with a darker brown patch on the breast. The beak is dark brown and the legs are pink.

"The Indian turtle-dove: Its back is brown, with the individual feathers marked with darker brown. At the back of the neck there is a black patch, spotted with white. The breast is brown, with a black beak and pink legs." Susan paused and held up a picture.

"Sheila has drawn a picture of both kinds," she said. "As you can see, the Senegal type is the smaller of the two."

"Thank you very much, Susan," said Miss Benson. "Now, Jim, what have you to tell us?"

"I worked with Steve, Alan, Paul and Frank," Jim said. "We studied the habits of the turtle-doves.

"The main food of both kinds is seeds. The doves are often found eating with fowls in the back yard, near wheat silos, or along railway lines or roads where grain is being carted.

"Their nesting season is usually during the spring and summer months, although nesting may take place throughout the year. The nests are cup-shaped and roughly made of stems and small roots. The Indian turtle-dove's nest is the larger of the two. Two white eggs are usually laid.

"The turtle-doves are usually found in the built-up areas of towns and cities. The few who find their way into the nearby bush do not seem to make their homes there. This is probably because they are able to find their food more easily in the towns and don't have to travel very far in search of it."

"Thank you, boys," said Miss Benson. "You have obviously worked very hard. We'll hear what you have to tell us now, Glenda."

"I wanted to find out if the turtle-doves have any natural enemies," said Glenda. "Apart from cats and birds of prey, such as swamp harriers, there don't seem to be any. Sometimes, however, the birds are killed when they fly into power lines, moving cars or glass windows."

"I found out where they first came from," said Helen, "and how far they have spread in Western Australia. The Senegal turtle-dove is a native of Africa and Asia and the Indian turtle-dove came originally from Asia. Both were introduced into Australia in the 1870's and to Western Australia in 1898. For many years they did not spread far from the metropolitan area, although there seem to have been some in Kalgoorlie at an early date. One of the first country areas where they were seen was Northam. After that they spread, in a series of jumps, from one town to another. They are found in many country towns now from Geraldton to Esperance, particularly in the larger centres like Northam, York, Beverley, Brookton, Pingelly and Narrogin. Of the two varieties, the Senegal is the more widespread."

When Helen had finished, Miss Benson looked around inquiringly. Steve raised his hand.

"When my uncle lived in Perth, he helped to study the homing ability of the Senegal turtle-dove. The birds were banded and were caught again some months later. Most of them were found in their original areas, proving that, having established a home territory, the birds seldom move far from it. Some birds which were released up to 100 miles from their area had the urge and the ability to find their way home, even though they had to travel over unfamiliar country."

"Thank you, Steve!" said Miss Benson. "You have found out a great deal about the turtle-doves—much more than I knew. Thank you for working so hard. I am sure that you will never again call a turtle-dove a pigeon!"

Questions and Activities

1. Are both types of turtle-doves in your district?
2. What is the farthest point to which these doves have spread?
3. Make notes on the activities of any turtle-doves in your district—e.g., nesting, feeding, teaching young to fly.
4. Which of these two doves is the larger?
5. Listen to the calls of these two types of doves and try to learn to recognize each by its own call.

"SPITFIRES" AND SAWFLIES

Something was stirring by the midrib of the gum leaf. For a month or more now, this leaf had looked different from the other gum leaves around it. On either side of the midrib there was a thickness which they did not have. Now, tiny grubs were breaking through the skin of the thickened sections and crawling out onto the leaf. More and more appeared, until dozens of them almost covered the surface of the leaf. Here they remained through the rest of the day, clustered together in a rough circle, their heads pointing outwards. A new colony of **sawfly** larvae—known to many people as "spitfires"—had hatched.

With nightfall, the larvae moved again, this time outward to the margin of the leaf. Strong biting jaws sliced at the leaf's edge, shaving it back until all that remained was the midrib and any vein too large for the hungry little grubs to attack.

This, of course, was not the only leaf on the branch. As the nights passed, the colony of spitfires moved over twigs and branches, shredding leaf after leaf. Each dawn, however, saw them return to a central point, to gather in a mass around a small branch or at the junction of a cluster of twigs. Here, tangled together, they would sleep through the day, unless disturbed by a movement of their resting-place—perhaps a bird landing close by, or an animal rubbing against the tree trunk. Whenever this happened, they reacted immediately.

One day, a bronze-wing pigeon landed not far from the mass of resting spitfires. The weight of the bird sent a quiver along the branch. At once, the spitfires went into action. Heads and "tails" were raised and waved in the air, while a strong-smelling yellowish fluid was squirted out. The pigeon, with a startled look at the vigorously waving mass of spitfires, launched itself from the branch and flew off.

It is the ability to produce this fluid, bitter and smelling largely of eucalyptus, which has led to the common name of "spitfire" for the sawfly larvae. The fluid, a by-product of all the gum leaves eaten by the larvae, is stored by glands in the thorax and squirted out in time of need. Whether it really discourages attack by birds or not, it certainly warns humans against touching, or even approaching too closely, a cluster of spitfires. The fluid has a clinging and long-lasting smell.

A bird which has been observed to ignore the fluid and eat the abdomens of spitfires is the twenty-eight parrot.

As the weeks passed, the larvae grew steadily, moulting several times. Their sturdy, thick, caterpillar-shaped bodies had dark, leathery skins which were striped with lines of light-coloured, bristly hairs. Whatever the spitfires did, they did as a group; it would have been difficult to pick out any as individuals. Though, as they grew older, they might scatter over the whole of a small branch to eat, first light brought them all

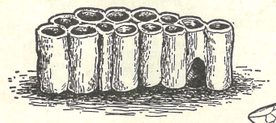
An Activity

There are several species of sawfly, which differ in behaviour in small ways. Some are thought to raise their heads **or** their tails when disturbed, and there seems to be some confusion as to the region from which the unpleasant fluid is discharged. Again, some reports describe moving spitfires tapping with their heads throughout the mass of moving bodies ,and others say they tap with their "tails". If you are able to watch a colony of spitfires, make notes. of all such details and compare them with the activities described in the article and with notes made by others in your school class.

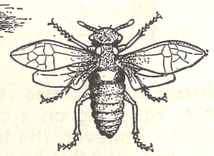
back to form their dense cluster once more, as if they had been drawn by invisible threads.

This clustering together in the daylight hours, when the larvae are most open to attack from birds or parastic wasps, gives them greater protection. An enemy which might pounce on a single spitfire would hesitate to attack a mass of waving, tentacle-like heads and bodies, even without the presence of the unpleasant fluid. No one knows what draws

the saw, magnified



cocoons in the ground



sawfly

the whole colony together again in the one place. It may be due to sense of smell; it may be due to a sense which records the vibrations of other members of the group moving and tapping with heads or tails on leaf and twig. The fact remains that they do re-form their cluster for each rest period as if they had appointed the spot beforehand.

Sometimes the spitfires had to move elsewhere to seek new food supplies. Naturally, they moved as a group—tightly packed, each grub resting its abdomen across the thorax of the larva behind it. The leading larvae waved their heads in the air, then thumped them on tree trunk or ground. This seemed to be a signal to those behind it, which tapped the hard tips of their abdomens against the following spitfires. The larvae at the rear of the group tapped their "tails" on the ground. Using this communication system (as it seemed), all the members of the group were able to keep in touch as they moved along. Yet their movement was not steady and smooth. After crawling a few inches, the spitfires would halt for a while, not moving on again until the whole process of waving and tapping had been gone through once more.

At last, there came a day when the larvae neither ate nor rested. Instead, they began to crawl down the trunk of the tree they had last occupied. Once on the ground, they started to burrow, pushing down through leaf litter and surface dust into the soil beneath. Their time to pupate had come.

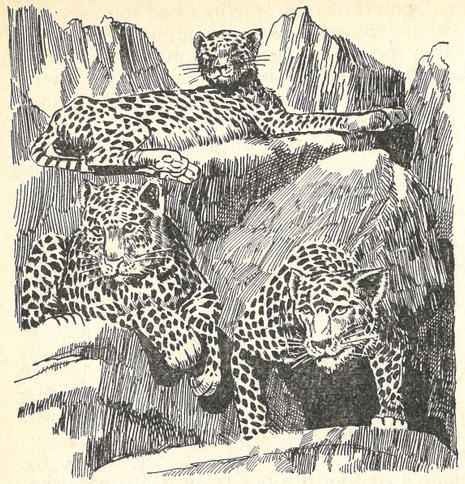
At this stage, the larvae separated a little —just enough for each to form a cocoon, though these cocoons were massed together like cells in a honeycomb. The cell walls were formed of soil and rubbish, soaked with the fluid excreted by the spitfires. The walls dried hard, black and waterproof—a splendid protection for the grubs which were changing their form inside.

Some sawflies pupate (make cocoons and change to adult form) over the summer months, emerging in February or March. Other species remain in the ground during the coldest months of winter, and come out in the warmer days of spring.

The insects which finally emerged from the cocoons in the ground were adult sawflies—flying insects a little like thickset wasps, with strong, almost transparent wings. The females also possessed a special instrument, which they soon put into use.

A female which was ready to lay her eggs examined a number of leaves on a gum tree and chose one which had only recently become mature. She worked on this for a long time, scraping at its waxy surface with the underside of her abdomen. After that,

(Continued on page 42)

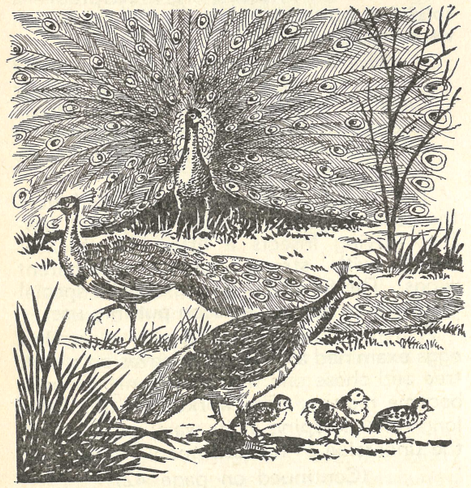


WHEN ANIMALS ARE GATHERED

The baby scorpions are born alive . . . and for a time ride in safety on her (the mother's) back. For this assemblage I coined the collective noun "a perambulation of scorpions".

So writes Vincent Serventy, the well-known naturalist. He is only one of a long line of people with an interest in animals, who have coined expressions for a group of animals of one type. Some of these terms are very familiar—for instance, **a flock of sheep.** The connection between a flock and the creatures which **flock** together is fairly plain.

Similarly, **a swarm of bees (or eels)** describes the actions of these creatures, while a **string of ponies** is descriptive in a different way, suggesting a long line of horses **strung** out one after another. **A**



brood of chickens reminds us of the hen-bird brooding on a clutch of eggs. Sometimes, however, the term **a peep of chickens** is used, and this brings a picture of the new chickens peeping from broken egg-shells or from beneath the hen's feathers.

Certain terms, less familiar than those mentioned, seem to have grown from the way in which animals behave. **A leap of leopards** is one example, and others are **a murder of crows** and **a skulk of foxes. A labour of moles** gives some idea of the way the animals toil to dig their long burrows

through the ground. An old term is **an ostentation of peacocks,** which fits these birds perfectly with their showy (or ostentatious) displays of magnificent tail-feathers. **A siege of herons** is thought to refer to the dogged way in which these birds will wait in the shallows of rivers and pools for prey to come their way (keeping siege or watch). **A shoal of fish** probably comes from a Dutch word meaning "school", reflecting the seemingly disciplined way a gathering of fish moves through the water. The term **school** is also used for some fish, as well as for members of the whale family.

Many of the expressions are hundreds of years old and were used by huntsmen in the days when hunting was the chief sport of kings and nobles. Apparently a knight who could not use the proper terms for **a nye of pheasants** or **a singular of boars** would not be fit to join in the chase!

Did you know that a group of kangaroos should be called **a troop?** It seems likely that any Australian seeing a number of kangaroos together would say he had seen **a mob** of them. The word **mob,** we are told, is also an Australianism for a number of cattle, elsewhere called **a herd.** (There are, of course, exceptions to the use of the word **mob** in Australia. It is quite common for people to speak of so-and-so's fine herd of cattle, but they usually mean all the cattle the person owns, rather than a gathering of a number of them.)

Some terms seem to have been coined to echo the sound of a congregation of birds—**a gaggle of geese, a clamour of rooks,** and **a chattering of starlings.** Other terms, again for gatherings of birds, give delightful suggestions about the appeal of those particular birds, such as **a charm of finches** or **hummingbirds** and **an exaltation of larks.**

Besides all these long-known collective names, modern writers and compilers of dictionaries have exercised their sense of humour and invented names for groups of all sorts of people. **A riot of boys, a clatter of milkmen** and **a scamper of children** are not meant to be taken seriously or to be adopted for either natural history or the chase!

Many other collective terms for animals exist, some with fairly obvious meanings and others whose origins are more difficult to decide. Keep a list of any you find in your reading. You may also be able to make up some good ones of your own!

THE QUENDA

Of the many small marsupials which have become rare with the spread of settlement in Western Australia, the quenda seems to have suffered least. It may not be seen a great deal, for it is largely nocturnal, but reports from various parts of the South-West suggest that it is not uncommon in the bush and its fringes. It is said to be abundant in the Darling Ranges and parts of the coastal plain.

The quenda, or southern short-nosed bandicoot (**Isoodon obesulus**), may measure, at most, fourteen inches from the tip of its nose to the root of its rat-like tail. The tail itself may be of varying length, for it seems very brittle and is often damaged. The coat is made up of long, bristly hairs of speckled dark-brown and yellowish colour, over rather scanty, soft greyish under-fur. The hair on the under surface of the body and the inner surface of the limbs is pale yellow or yellowish grey.

The quenda has a sturdy body and short, stumpy legs, of which the front ones are shorter than the hind ones. There is not as big a difference, however, as there is between the hind and front legs of the kangaroo. When it is in a hurry (which is almost always), the little marsupial bounds and hops, but all four legs are used; it does not hop in an upright position as do such animals as kangaroos and wallabies. Two of the "fingers" on the "hands" have long, strong, curved claws, well suited to the quenda's constant activity of digging.

Though this bandicoot is called "short-nosed", its head is rather long, narrow and pointed, and its ears are short and rounded. The quenda is very well provided with teeth —no less than 48 in an adult. They are the teeth of an animal which eats insects, spiders and other small game, but not, as a rule, vegetation. Quendas used to be blamed for damaging potatoes and other underground crops, but close observers deny this. Their digging or scratching, these observers say, is in search of worms and the larvae which attack root crops. Mr L. Glauert, when Curator of the Perth Museum, wrote quite feelingly on the subject.

"The species is often accused of being a pest in gardens and potato fields, but my investigations suggest that the diggings and scratchings are in search of grubs and worms, and not because the animal desires a feed of raw potatoes. Mice, young dead birds, insects of all kinds, scorpions, spiders, centipedes, small lizards and snakes were eaten (by a captive quenda) with the same gusto, and each creature was tackled in the most suitable manner. Scorpions were seized by the tail, centipedes by the fore end of the body; and all were put out of action before any attempt was made to eat them. Dead mice were vigorously patted with the forepaws and the skull crushed; and then they were devoured, fur, skin, bones and all. The animal could not be induced to feed upon potatoes or root crops, although the leaves were eaten now and again. Sweet apples, peaches and grapes were greatly appreciated, probably because of their sweetness; but as the quenda is not a tree climber, it is unlikely that this fact is of serious consequence.

"Quendas have been accused of attacking chickens, but I fancy they are in this case blamed for the evil deeds of the chuditch, or native cat."

Mr Glauert commented on the nature of the quenda which was kept under observation at the Museum for over three years: "This animal soon became quite tame and could be handled without risk of any kind. It would come when called and had a most friendly disposition. Its intelligence was of a low order."

Another reason for digging might have been a search for cocoons. Mr W. H. Loaring reported to the Western Australian Naturalists' Club on "the most remarkable concentration of quenda diggings I have seen", which he found in the Darling Range in 1952. "This was in a comparatively bare area about two chains long by half a chain wide, where twelve inches or more of gritty soil had found lodgement on a shelf of granite high on one of the hillsides. In it there were literally hundreds of fresh pits dug by these animals and in each case we found that the pit had been dug to unearth the cemented pupa cells of some insect, most of which had been broken up and the inmates devoured. Later some of the undamaged cells were sent to the Curator of the W.A. Museum, Mr L. Glauert, and to him I owe thanks for the information that they were the pupa cells of a sawfly . . . My wife and I again visited this spot in June, 1954, but though it was obvious that many more pits had been dug since our earlier visit very few were fresh. The area had been rendered rather unsuitable to the insects by the uprooting it had received."

It is thought that the holes dug by quendas seeking food are sometimes confused with those dug for the same purpose by sand goannas, though the holes dug by the goannas can be told by the fact that they are ridged on the digging side. In captivity, a quenda will eat many things, but they seem to develop a particular fondness for milk or food made from milk, such as custard, and they have even been known to share a bowl of milk with the farm dogs.

The claws of the quenda's forefeet, so useful in seeking food, also come into play in home-making. They will sometimes shelter in hollow logs, but usually they begin with a scrape in the ground. This might be under the roots of a melaleuca (paper-bark) or beneath the drooping, grass-like leaves of a low-growing blackboy. A female quenda held at the Zoology Department of the University of Western Australia dug a series of sloping burrows, up to 15 inches long, which seemed to be meant as shelters from the heat. However, "nests" built by the quenda seem to be a common form of shelter. Mr Glauert described the process of nest building.

"A bandicoot intent upon 'house-making' will level off the surrounding vegetation as though a scythe had been through it, and for a while the nest is conspicuous because of the bare patch. Soon, however, grass begins to grow from seeds, and the material of the nest itself, which is constructed of grass and dead leaves, strikes root, and the seeds in it germinate, and then the structure becomes concealed by its own little thicket, making it difficult to detect.

"The nest is made of grass and other plant growth, and is usually placed in some tangle of vegetation where all the greenstuff available is collected and piled in a heap, often forming a mound of some considerable size."

(Mr Loaring writes of "nests that we concluded were the work of these animals. One of these was a mounded structure built of sticks and leaves and other herbage and was situated in a tall thicket of **Bossiaea** (one of the many pea-flowered plants) in a low-lying area, but two others of similar composition were in hollows or excavations under the beards of low-growing blackboys, and the flat tops of these were level with the ground.")

Mr Glauert continues: "No permanent entrance is provided, for when the animal emerges it at once sets about making its bed, shaping up the mound and closing the entrance in the process."

Another naturalist described simpler nest building: "The ground—which was soft soil—was bestrewn with twigs, leaves and bark to provide the bandicoot with some cover. Its first chore was to dig a scrape, which it concealed with bark, leaves and twigs and under which it would lie up, completely out of sight, during the day."

Though noctural, the quenda, like the kangaroo, may feed in the late afternoon or early morning, and being abroad in daylight does not seem to worry it. Mr Loaring says, "The quenda is sometimes seen in the daytime, but mostly only in a fleeting glimpse as it shoots across an open space or a bush track in front of one."

The chief enemy of the quenda appears to be the introduced fox, which is said to kill less for food than for the sake of killing. The bandicoot can be quite savage itself, even with another bandicoot, which it may regard as having strayed into its own territory. Mr Glauert gave an account of fighting between two quendas.

"The method of fighting is peculiar, for they never fight face to face, the aggressor merely tirelessly following his victim until he has worn him down.

"Whenever they come to close quarters a series of curious little sounds is emitted, and then the pursuer jumps over the other and tries to strike it on the back with the strong claws of its hind feet. Each stroke, if carried home, removes some fur and skin of the victim's back, and finally when the poor creature is weakened through loss of blood and over-exertion, the other will attack with that curious quick scrambling motion of the fore feet which they practise when insects, mice or even raw meat are tackled prior to being eaten. Serious damage is then done by the strong claws, and when the victim is incapable of further resistance he is seized and his skull crushed in the powerful jaws."

The quenda is a true marsupial, the female having a well-developed pouch which opens downwards and backwards. (This is characteristic of a number of digging marsupials, apparently preventing the dirt scratched out in hole digging from flying into the pouch.) The young are said to number from four to six and, like the young of other marsupials, they climb into the pouch at birth and cling there, feeding on their mother's milk, while they grow larger and stronger in preparation for taking care of themselves.

"Spitfires" and Sawflies—Continued from page 37.

she went to work with her "saw". This was a structure with fine, sharp teeth, usually sheathed at the tip of her abdomen. (Only females possess this saw.) With it she cut a series of slits in the skin of the leaf, close to the midrib. In each slit she deposited a number of tiny eggs. From these would hatch a new family of spitfires. The cycle would then be complete.

The larvae of the sawfly differ from those of the wasps, ants and bees to which they are related, for the spitfires are able to support themselves at once, moving about in the leaves and using their strong jaws to obtain food. The young of other insects are fed for some time by older members of the family (as with ants and bees) or are provided in advance with a store of food left by the mother (wasps).

SWALLOWS

"Those swallows are back! I suppose they'll be nesting under the verandah roof again, as they did last year and the year before. I like the little birds flitting about, but they really do make such a mess of the verandah!"

It was last August when Mrs Hunter made these remarks. She was watching a pair of **welcome swallows,** each carrying a beakful of mud.

"They seem to be building up their old nest again," said her daughter Alice, looking closely at the busy pair of little dark-backed birds as they darted under the edge of the verandah roof and fluttered around a basin-shaped nest high in one corner. "This will be the third year they've nested in the one spot."

"I wish they'd decide to nest somewhere else for a change," Mrs Hunter grumbled, "so that I could keep the verandah tidy. I've heard that the best way to discourage them from nesting where they aren't wanted is to paint the spot with sump oil or some other grease. When the birds try to place the wet mud there, it slides off."

"I suppose that after a while the swallows give up in despair and go away," said Alice. "It might be worth trying."

"Ye-es. It seems quite a good idea," Mrs Hunter said doubtfully, "but I really don't think that I could be hard-hearted enough to do it."

The two welcome swallows, not knowing what might have happened to them, continued to repair their former nest, twittering excitedly to each other as, with their short, broad, pointed beaks, they deftly set the mud in place. Soon the nest was nicely rounded again. It was rather deeper than it had been the previous year, and the outer parts showed a rough surface made up of pellets of dried mud they had carried from the nearest mud-bank and had mixed with a little dry grass. Anyone able to peer over the edge of the completed nest would have seen that the inside was snugly lined with soft materials such as feathers and bits of fur and grass that the hard-working birds had gathered.

Before long, the female swallow would lay two or perhaps three whitish eggs spotted around the heavier end with pale purple. The parents would then take turns in sitting on them.

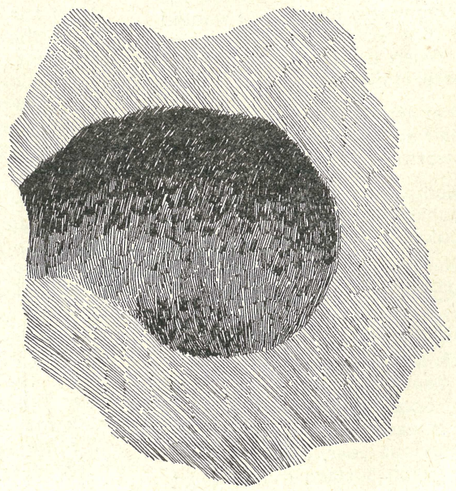
The welcome swallow is not a brightly coloured bird. Its back and crown are a glossy blue-black, the tail and wings are mainly dark brown, and the underparts are a dull white. The forehead and chin are chestnut-brown. (Male and female look alike.) In the air, welcome swallows can be distinguished easily from any other of the true swallows by the particularly long and deeply forked tails, the outer feathers of which grow like streamers.

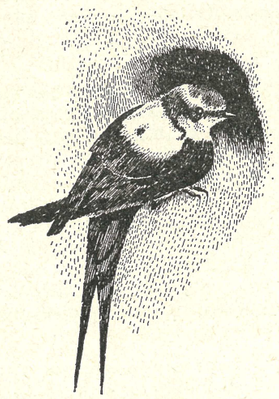
In Western Australia, where the climate is not very cold, there being little snow and ice, the winter months do not seem to affect the swallows greatly. This, however, is not the case in the eastern parts of the continent. There, at the end of summer, the swallows gather in large flocks, moving from Tasmania and Victoria to spend the winter in warmer northern areas. Because of these movements, the swallows of the Eastern States can be said to be at least partly migratory.

The same kind of migratory movement, but on a much larger scale, takes place among the swallows of the northern hemisphere. They actually fly overseas to avoid the very severe cold of winter. These swallows look very much like their Australian relatives, the main difference being a black edging to the chestnut-brown bib on the upper breast. (Children living in our far north may occasionally see a few of these, for some are known to visit our northern shores at times.)

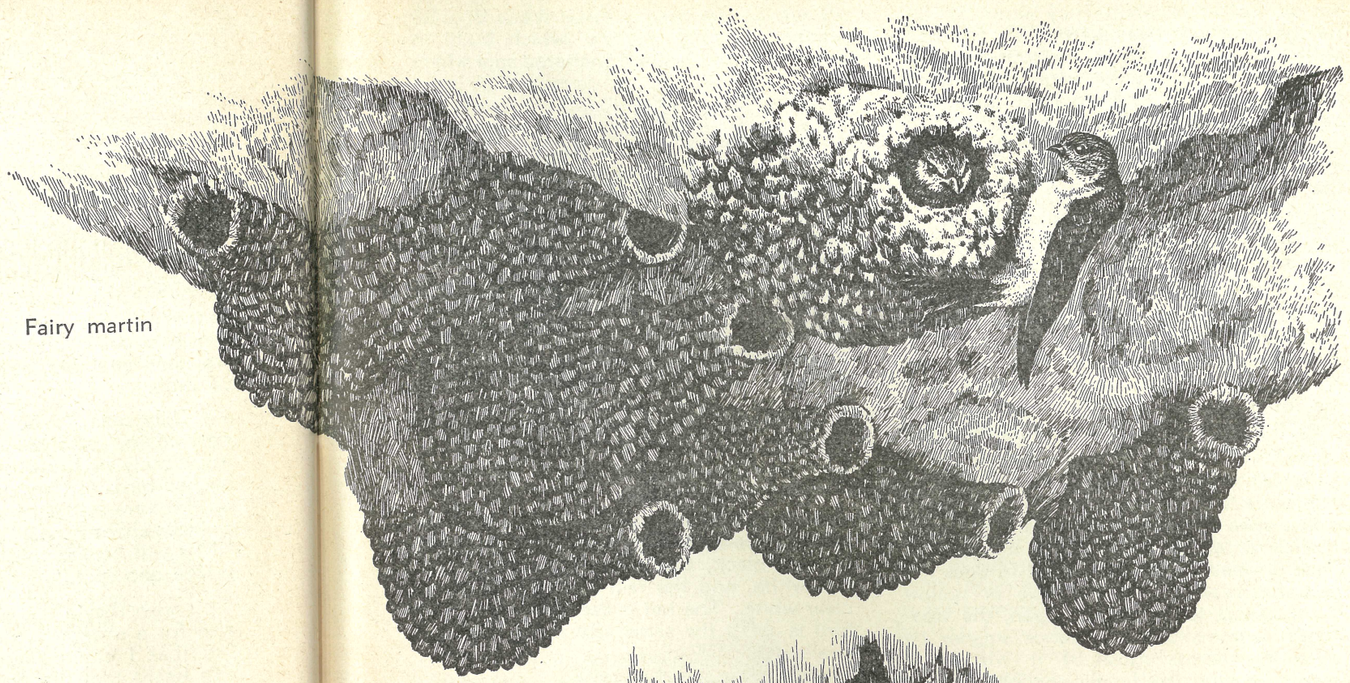
In earlier days, before a careful study had been made of the behaviour of birds, some very strange beliefs about swallows were held. People knew that these birds disappeared during the very cold weather

Tree-martin





White-backed swallow



Fairy martin

Welcome swallow

but did not know where they went. It was thought that swallows hibernated in the mud at the bottom of ponds, returning to the air when the days grew warm once more! Nowadays, through observation and bird-banding, we know a little more about their wanderings. However, there is a great deal more to be discovered before we can know the whole story.

Besides the welcome swallow, Australia has three other members of the group of true swallows. All three of them can be seen in our State.

The commonest is the **tree-martin.** In appearance it differs in several ways from the welcome swallow. It has no streamers on the tail, which is only slightly forked; the lower part of its back, where the tail joins the body, is a dull white; and it has no chestnut-brown bib.

As a rule, the tree-martin's nesting habits are also different. This bird nearly always uses a hole in a tree, a cliff or even a brick or stone building for its nesting-place, instead of making a nest as does the welcome swallow. If the hole or hollow it chooses is too large and open, the tree-martin will make the entrance smaller by plastering across most of it with mud pellets, leaving itself only enough room to enter easily. A few tree-martins have been known to make a nest resembling that of a welcome swallow; but, as a general rule, the tree-martin, as its name implies, nests in holes in trees.

Like all other members of the group of true swallows, the tree-martin has a graceful, skimming flight as it darts and twists through the air, catching insects on the wing. As one would expect of birds which make use of mud, these little swallows are often seen near water; indeed, they sometimes gather in large flocks, particularly over ponds and small lakes, where many kinds of flying insects provide them with food. The air is then filled with the twittering cries of the tree-martins, especially at dusk, when they rise and circle in the air before settling among the reeds to sleep.

Very similar to the tree-martin in appearance, except that it is even smaller and daintier, is the **fairy martin,** which is less than five inches in length. This small swallow also uses mud to build its nest, which it makes in a curious shape.

First, as the nest is to be made of mud pellets, the fairy martins (which build in colonies) must choose a sheltered spot where their nests will not be destroyed by rain. Like the welcome swallows, fairy martins make use whenever possible of man-made shelters such as the underside of culverts and bridges and the eaves of out-buildings on farms. In areas where there is no human settlement, natural shelters such as overhanging cliff faces, tree trunks and caves are used.

Having chosen a suitable spot, each pair of birds builds a rounded structure with an entrance which extends outwards for a few inches in the shape of a spout. These structures are built so close together that they touch one another, the finished colony of nests looking rather like a crate of squat, roughly made bottles. For this reason, fairy martins are sometimes known as "bottle swallows".

Perhaps the daintiest of all the swallows is the **white-backed swallow.** Its wings and tail are black, the head is mottled brown and white, and the rest of the plumage is clear white. The tail is deeply forked. This bird is about the same size as the welcome swallow.

The nesting habits of the white-backed swallow differ completely from those of other swallows. Instead of using mud pellets in some form, this bird digs a tunnel about two feet long in the side of a sand-bank. At the end of the tunnel, a nesting-place is scooped out for the eggs, which are usually four in number. Like those of most birds which nest in dark, hidden places, the eggs are white and have no markings.

Digging the tunnel must be a tremendous task for so small a bird, which has only its own weak little feet with which to scrape the soil away. White-backed swallows are said to keep the tunnels in good repair, even between the nesting seasons—no doubt because the making of a fresh tunnel is such a difficult task.

The four true swallows described should not be confused with another group of birds called "wood-swallows". These are slightly larger birds of different habits and appearance. They will be described in a later article.

DIBBLERS or RATS?

Dear Secretary,

Down by our creek, among banksia trees, we have found some little animals that look like the picture of the dibbler that was in the newspaper not long ago.

I have sent a letter to the Museum telling them about the animals, and some men are coming down here to look around.

I hope we were right, and the little animals really are dibblers.

* * * *

In 1967, a boy member of the W.A. Gould League, who lived near Mandurah, sent a letter on these lines to the secretary of the society.

Later, he wrote again to say that men from the West Australian Museum had visited the spot and for several nights had set box traps among the banksias. Although they had managed to trap a few bush rats, no dibblers had been found.

The term "bush rats" can include some kinds of native rats and some that were introduced from other countries. (The introduced rats would have travelled to Australia in ships' cargo and made themselves at home in their new land.) All these rats are **rodent mammals**—that is, they have sharp, chisel-like front teeth for gnawing and the mothers feed their young on milk—but they are not marsupials; they do not carry their young in a pouch.

The dibbler for which the trappers were searching is a true Australian **marsupial mammal.**

When many years had passed without anyone having seen a living dibbler, the little animal was thought to be extinct. The reference books stated that it had at one time been found in several settled areas of the South-West, such as the Moore River, Perth and King George Sound regions. John Gilbert, while collecting birds and other animals for the famous John Gould, visited all three of these localities during the 1840's, and saw some of the little animals. The natives called them "dibblers" and showed Gilbert the nests they made. Gilbert wrote descriptions of the little marsupials in his notebook and stated that they could be found over the whole of Western Australia. They must at that time have been fairly plentiful.

According to the records, over 80 years passed without a single dibbler being caught. No wonder people thought the little marsupial must be extinct!

In January, 1967, however, a man named Michael Morcombe caught one, quite by accident, near Albany. One evening, he had set a special fly-wire cage trap, which he fitted over the large flower of a banksia, hoping to trap a tiny honey possum which might visit the blossom for nectar. Imagine Mr Morcombe's surprise and delight when, the following morning, he found not a honey possum but one of the long-lost dibblers, which had become trapped in the cage!

This was indeed an important and exciting catch. The dibbler was placed in a roomy enclosure with plenty of the food it seemed to favour, and Mr Morcombe fixed his special wire cage over another banksia flower. He thought that where there was one dibbler there would probably be others. He was quite right. Soon he found another precious prisoner in his trap. With two

dibblers in the big enclosure, he was able to make detailed observations.

This interesting marsupial is about the size of a small rat. The tail, however, is different from that of a rat. It is shorter, it is thick and hairy where it joins onto the dibbler's body, and it tapers to a thin tip. Long ago, when the dibbler was first noticed by collectors, it was referred to as "the speckled marsupial-mouse". There were two reasons for this name—its size, and the fact that the white tips on the longish hairs of its dark red-grey coat gave it a speckled appearance. (Nowadays, it is thought that the dibbler is related to the same group of marsupials as the native cat.) Besides the white tips on the hairs, the dibbler has a narrow white ring around each eye.

Observation of the two captive dibblers showed that they were fond of the nectar found in banksia flowers. They also ate insects of various kinds, including large grasshoppers. The following is a note on their feeding habits written by Mr Morcombe.

"When a dibbler catches an insect, it grabs it in its forepaws and holds it while it eats, always directing the first bites at the insect's head. Spiders and other prey that might be dangerous are not grasped immediately but are dealt several quick, buffeting blows before being snatched up and given a quick bite. They are then dropped, snatched up again, given a quick bite or two, dropped again, and then eaten or further disabled."

Mr Morcombe further reported that his captive dibblers also ate small pieces of meat. This, together with their appetite for large, fleshy insects such as grasshoppers, shows them to be **carnivorous** (flesh-eating). You probably know that most of our larger marsupials, such as the kangaroo, eat only grasses and leaves—that is, they are **herbivorous** animals. Some of our other, smaller marsupials are, like the dibblers, at least partly carnivorous. Among these are the bandicoots and the dunnarts.

The big, nectar-laden flowers of the banksia and those of other blossoming shrubs attract insects, which come to sip the sweet liquid. These insects, moving from one blossom to another, help pollinate the flowers. It is thought that small animals like the dibblers, which visit the flowers for both nectar and insects, must also help in cross-pollinating.

Other interesting habits were observed in the captive dibblers. They seemed to enjoy licking up drops of dew that hung from the leaves of shrubs. It was also noticed that they were most active early in the morning at first light, and for a few hours around sunset. The rest of their time was spent curled up, sleeping, in the litter at the bottom of their enclosure. (Many other marsupials behave in much the same way, resting during the warmest hours of the day and feeding during the evening and early morning.)

One of the captive dibblers was found to be a female; she later gave birth to a large family of eight. Dibbler babies, each less than half an inch in length, are born hairless and are unable to see. They are carried around in the mother's pouch. It is thought that the young remain inside the pouch, clinging by their mouths, for about a month, before they are ready to begin life as individual young dibblers. The pouch in these small marsupials is not a deep pocket like that of the kangaroo, but is more like a fold of skin which opens downwards. This is probably sufficient to protect the babies against being scraped against rough twigs and leaves as the mother climbs to reach blossoms. You may know that the pouch of a mother bandicoot opens downwards or backwards, which means that she does not scrape soil onto her babies when she is digging. The downward-opening pouch of the mother dibbler is also adapted to her way of life.

Note: Please bear in mind that we are very interested in learning more about the rare little dibblers and their habits. Should you see or hear of any in your district, send a note to the Secretary of the W.A. Gould League, Subiaco Road, Subiaco, or to the W.A. Museum, Beaufort Street, Perth. They will be very glad to hear from you.

For Further Reading

"Nature Walkabout," Vol. 1, No. 2, "John Gilbert, Bird Man".

"Nature Walkabout," Vol. 2, No. 2, "Noolbenger (Honey Possum)".

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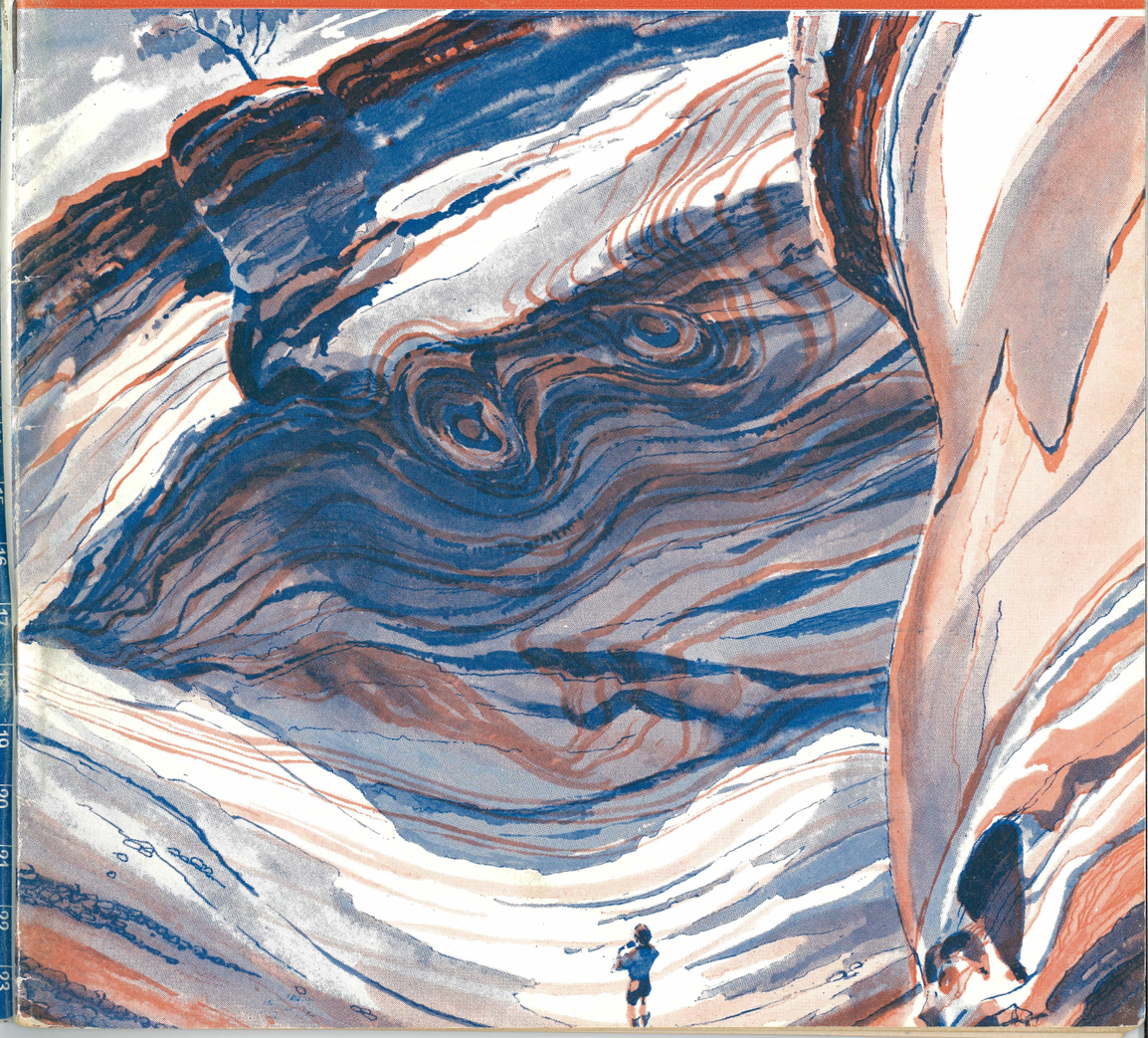
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